JUN 4 1923

Staff Report of American Water-Works Association Convention

Engineering News-Record

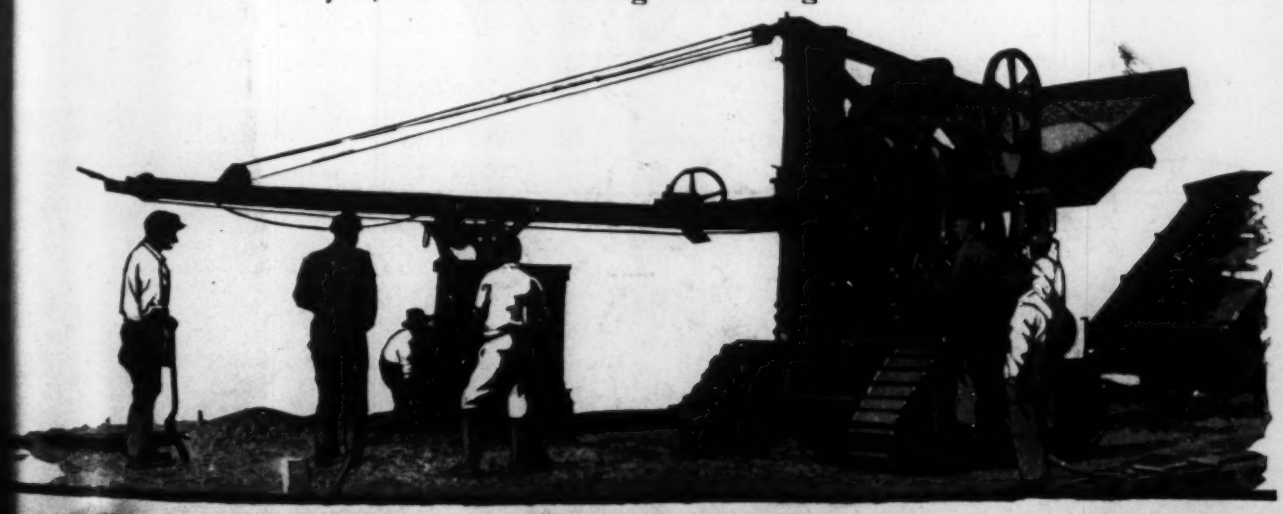
Devoted to Civil Engineering and Contracting. McGraw-Hill Company, Inc.

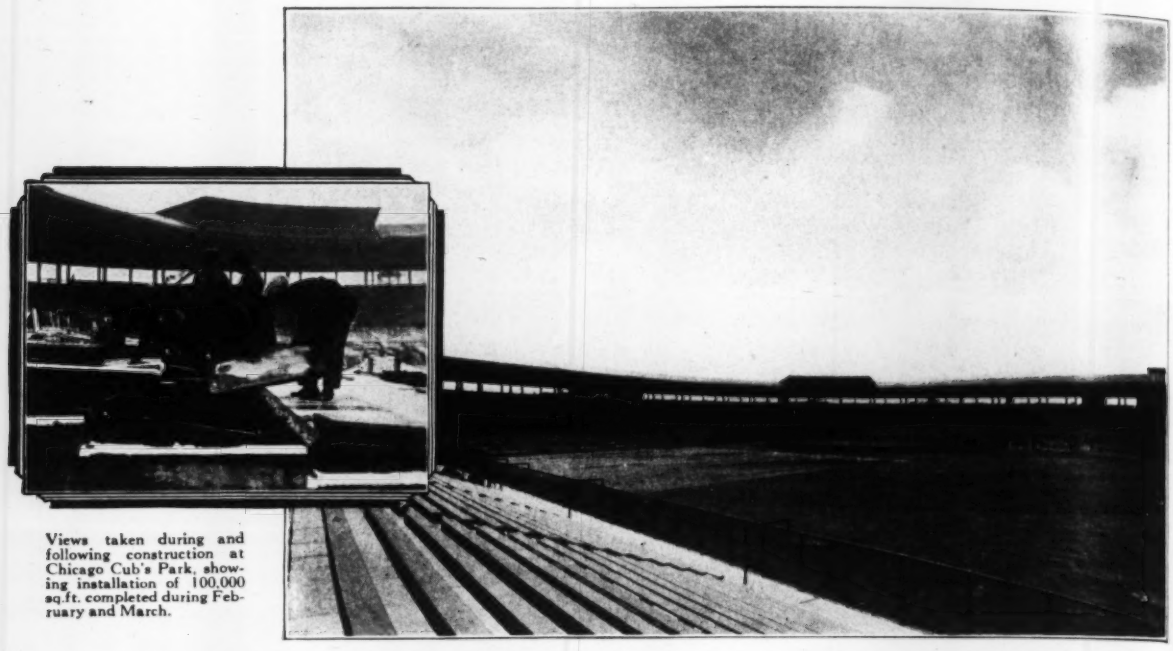
May 31, 1923

CONTRACTING presents many hazards. Often losses are sustained, even when favorable contracts are secured, through inexperience, bad financing, lack of adequate job planning, poor estimating, and inability to maintain smooth-running organizations.

In order to present intimate data on means which will overcome these disadvantages, Engineering News-Record presents in this issue in interview form, the first of a series of articles on the business of contracting. The first interview-article secured by C. S. Hill, associate editor, tells the inside story of how Henry W. Horst has built up a successful highway contracting organization.

Other articles, not on the details of single jobs but on general methods in the office and on the job, will follow during the coming months.





Views taken during and following construction at Chicago Cub's Park, showing installation of 100,000 sq.ft. completed during February and March.

FEDERAL Cement Tile

—*in the baseball line-up this year*

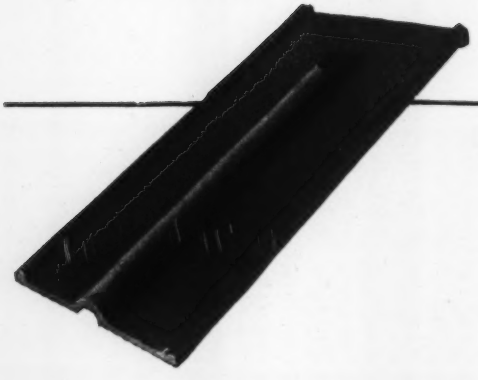
The first call of "batteries for today's game" found Federal Cement Tile playing an important position at the Chicago National League (Cubs) Baseball Park. Flat slabs are used for stepped flooring under the seats and in the aisles—an excellent use for Federal Roof Slabs because it will stand the continued walking, standing, and jumping of thousands of pairs of feet year after year.

By installing Federal Pre-Cast Slabs it was possible to rush the work through the winter months, uninterrupted by cold weather and snow—which would have been impossible if poured concrete were used. Moreover the use of Federal Roof Tile insured a lighter, stronger, more uniform covering.

The unqualified success of this installation — and hundreds of others—is of course the direct result of unmatched manufacturing facilities and long experience.

Federal Tile, for all flat and pitched surfaces, is

Made, Laid and Guaranteed by
FEDERAL CEMENT TILE CO.
110 So. Dearborn St., Chicago



"The Roof for Permanence"

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

Volume 90 — NEW YORK, MAY 31, 1923 — Number 22

Concrete and Clay Brick

THE extensive tests on concrete and clay brick made at Columbia University and reported in abstract in this issue are a most valuable contribution to the knowledge of the behavior of material. Preliminary information regarding these tests was placed before the brick committee of the American Society for Testing Materials last June, but a specification based on the facts reported was rejected by the committee as premature. It is no secret that the concrete brick people charged that this action was dictated by the clay brick interests, which are predominant among the producers on the committee, because of the apparent better showing of the concrete product. Whether or not that is true there is no escaping the facts as set forth in the Columbia tests. The behavior of concrete and clay in brick piers is strikingly different. The concrete brick, bound together with cement mortar, act almost as a concrete monolith while the bond between clay brick and mortar sets up obvious planes of weakness. In consequence, the individual brick strength is no criterion of pier or wall strength where concrete and clay brick are being compared. The A. S. T. M. committee, in its report to the coming convention, can hardly avoid reference to this fact nor can it avoid taking one of the alternative steps of incorporating it into specifications or controverting the apparent conclusions of the Columbia tests.

Another Warning

FOLLOWING in the regular succession of flood visitations which have come to our cities in recent years, the Hot Springs flood of two weeks ago repeats the prior warnings that every community ought to consider its own flood danger and provide against it with the least possible delay. No loss of life was involved in this latest case, fortunately; but flood fatalities are somewhat a matter of chance, and their absence at Hot Spring is of no great significance. Repetition of the same flood might mean a large death-list. In any event the property and business damage was decisive in this case as in others. The losses were sufficient to warrant a very large expenditure on flood-prevention measures. Under the conditions existing at Hot Springs preventive measures are particularly urgent. A narrow gap must pass the flood flow from a basin in which precipitation can concentrate quite rapidly, and the city built in the gap is under a quite obvious threat. Nothing was needed but an abnormal downpour of rain to bring about a destructive flood under these topographical conditions. Such floods have come to Hot Springs several times in the past three or four decades, according to the report which we printed last week (p. 922), but the 1923 flood was much the most extreme. Valuable information will be added by this occurrence to the growing record of flood facts, and evidently it puts new emphasis on the need for very careful advance planning against the flood hazard. It exemplifies anew that moralizing about floods after they have happened is poor comfort and will not restore a dollar of loss. Gradually there is building up in the public the realization that extraordinary precipitation may occur at any time and, so far as is yet known, almost anywhere. Our weather observers have not yet managed to tell us what regions are especially susceptible to cloudburst rainfall and flood, and what regions (if any) are immune. From present facts the only safe conclusion is that every community has a flood hazard and that contrary to local beliefs this hazard may be very serious. A community can protect itself only through timely study of flood contingencies and flood-prevention possibilities.

Getting Acquainted

MUTUAL co-operation and understanding between the engineering school and the industries to which it furnishes human material are most necessary if both are to prosper. Such a desirable end is furthered by the conferences which were initiated at Pennsylvania State College some years ago. At the latest of these, held last week, a hundred or more representatives of the leading industries of Pennsylvania met with the engineering faculty in discussion of the problems of engineering extension work and the summer employment of students. Part of the value of such conferences lies in the interchange of views on the formal subjects presented for discussion, but an equally great part is played by the better acquaintance that is thus developed, the better appreciation of the industries' needs by the teachers and the better appreciation of the college's facilities and intentions by the prospective employers. At State College last week one outstanding hopeful note may be mentioned. The industries there represented are by no means demanding that engineers be turned out of college merely as fuel to feed the human machine of industry. Rather did they accent the long look ahead and urge that the men be trained to think and to work, having faith that men so trained can soon learn the technique of whatever line they follow. So many industrialists in similar conferences have overemphasized the selfish and narrow view that it was refreshing to find some of the leading men in a leading industrial state in opposition.

Public Works Development

IN DIRECTING attention to the relation between the onerous tax burden and public improvements, Prof. A. N. Johnson, in his remarks abstracted last week (p. 917), stimulated thinking on a troublesome and complex subject. It is a very necessary subject to think about, most so for engineers, who as a class are directly affected by progress or lag in public-works construction. Within a generation or two there has been

tremendous progress in developing public services, and their costs have been piling up almost unnoticed. Suddenly we have come to a realization that the costs have mounted higher than we taxpayers are prepared to approve. But there is no possibility of reduction of present costs, except through increasing the efficiency of administration and eliminating the many extravagances and wastes that still surround municipal activities. This, naturally, must be a matter of time. On the other hand, the repressive effect of the present discontent with high taxes upon further development of public-works construction is immediate. While in some fields of work, as road paving, full activity continues, with general approval, the main fields of municipal development are handicapped. One remedial measure was indicated in Prof. Johnson's remarks: Careful planning of what public works are needed for some time ahead, and consistent adherence to the program so developed. And as he also pointed out, the engineering community has an essential part in helping forward such planning, by study of the costs and needs of public services.

Egypt, Politics and Irrigation

THAT Egypt is still the Nile and the Nile Egypt is shown by portions of the new constitution of Egypt, signed by the King on April 19. After much discussion, certain disputed clauses as to British and Egyptian sovereignty in the Sudan were replaced by others leaving the points at issue undetermined until the status of the Sudan is determined by Anglo-Egyptian negotiations. Presumably questions of Nile waters allocation between Egypt and the Sudan are directly or indirectly involved, along the lines indicated by H. T. Cory, consulting engineer, in his minority report on Nile problems, abstracted at length in *Engineering News-Record*, April 21, 1921, pp. 679 and 869. Naturally, Egypt wishes the storage and control of the Nile in the Sudan so handled as to insure it the largest possible amount of water for Egyptian irrigation. Large questions concerned with river control and utilization by the construction of huge reservoirs on the Blue and the White branches of the Nile are involved. These questions have been long in controversy. Whether Egypt under its new democratic constitution, wrung from the King by the force of public opinion, will be fairer or as fair to the Sudan as was Egypt under British rule is an interesting subject for speculation which cannot be gone into here. That the land of the Pharaohs is at last under a constitution that provides for the compulsory education of both sexes, and representative government with a chance to pass legislation over the King's veto, is nearly as marvelous as the almost numberless dynasties of old, the Nile and the centuries of irrigation in Egypt. The final outcome of the Egypt-Sudan claims to the Nile waters in the Sudan and of the associated river utilization and control problems will continue for decades to hold the interest of the hydraulic and irrigation engineer.

Camouflaging Traffic Obstructions

WAR taught us the striking lesson that to conceal any structure its lines must be broken up by dividing the surface into sharply defined sections of contrasting color. Inconsistent as this method seems, its effectiveness is beyond question. Now—in spite of the lesson so learned—a similar method of painting traffic obstructions has been adopted in an attempt to do the opposite thing—to make them conspicuous. First, railroad crossing gates were painted in alternate black and white stripes, and now the columns of New York's elevated railway which obstruct the street traffic have been similarly painted. The loss of outline is not so obvious at many railway crossings because the background is frequently quite uniform, but if anyone doubts that such painting will obscure the object so painted he should see how effectively the outlines of New York's black and white elevated railway posts are lost in the medley of colors that form their background. We call attention to this for the benefit of highway men throughout the country who have similar problems to meet. Possibly some of the men who made a study of camouflage during the war can suggest the correct method of painting such obstructions. From our own observation we would suggest a uniform coat of bright orange. It is more conspicuous at night than red and is less liable than white to match any color in the background.

A First Step in Code Enforcement

IN ITS formulation of some rules of professional conduct, noted in last week's issue of *Engineering News-Record*, the American Association of Engineers has taken a logical step forward in its scheme of codifying professional practice. There are two ways in which professional codes of ethics may be developed. One way, adopted so far by the national engineering societies, is to write down some basic principles—similar in inclusiveness and tone to the commandments handed down to Moses—and by publication in the year book of the society give notice to the members of their obligations toward their fellows. The other way, followed by the Institute of Consulting Engineers and the American Association of Engineers, is to set up some basic rules and then to interpret these rules as they apply to specific cases, with the intention of thereby developing a body of what may be called common law which in time will be so broad as to cover any possible situation that arises.

The A. A. E. has now gone further. It has taken its interpretations, forty-four in number, and has reduced their specific rulings to 45 principles, in most cases of specific application. Thus, instead of the Mosaic commandment they have the direct injunction, with much less chance of misunderstanding when direct violations are in question.

Thus far the procedure of the American Association has been admirable and in advance of its fellow societies. It has recognized the frailty of human nature in applying general rules to its own conduct and has made it less possible to hide infractions behind general clauses. Sooner or later, though, the A. A. E., as well as the other societies, will have to come to even more specific application of its rules. The sure trend is toward an enforcement of personal responsibility of a member to his society's code.

Such personal responsibility, which entails the bringing and the trying of charges, cannot be insisted upon until a detailed set of rules is accepted and understood. The fine generalities of the average code are not sufficient basis for action. Too much is involved in any attack on an engineer's professional honor to permit such an attack without the surest of foundations. For that reason as much as any other—though the overworked idea of professional courtesy also plays its part

—rarely if ever have there been any public expulsions from the major societies.

If the societies follow the idea gradually being worked out by the A. A. E. they all in time will have a body of law—an itemized list of illegal or unethical practices of such extent and in such detail that any infraction may be specified by clause and sentence. With that, not impossibly there may be developed, too, a gradual scale of punishment, starting with reproof or warning and ending with public expulsion from the society. This means some machinery not now existent but its cost and the effort involved will be worth while. Other professions find it feasible. Why will it not work in engineering?

Every engineer hears almost daily about some practice or performance of another engineer which, depending upon the animus of the speaker, ranges from loose interpretation to wilful violation of the accepted codes. It is time such backstairs gossip and the performances which bring it forth should be slowed up. Now there is nothing but a man's own conscience and his reading of the code to stop him from doing as he pleases. Those who would violate such a code are not troubled with conscience and their interpretations are apt to be selfish. The numerous cases which are continually coming up show that something more is needed. No society can stop an engineer from practicing engineering as he pleases, so long as he obeys the law of the country. But a rightly developed engineering society can in time establish definitely what is right and what is wrong in professional conduct and can then seek out those who violate such principles and deny them membership among the right-minded men of the profession. The first step toward such a desirable end is to make specific our ethical codes, now largely glittering generalities.

Sound Conservatism on Sewage Treatment

IN REFUSING to approve the plans for the direct-oxidation process of sewage treatment submitted by the City of Trenton, the New Jersey State Board of Health has put itself on record as still considering that process of sewage treatment in the experimental stage and as believing that a simpler and less costly plan would meet local conditions for "at least ten years and probably for considerably longer." In the first of these positions the board is in agreement with the opinions of engineers generally and in the second with a principle followed by some of our leading state boards of health and deserving of general adoption. The attitude of the board is so well stated in the preamble and resolutions which constitute the denial of the permit that we reprint the document elsewhere in this issue.

The board's recommendation of plain sedimentation might have been based on three grounds besides those mentioned in the resolution: (1) Sedimentation is all that the New Jersey-Pennsylvania agreement for zoning the Delaware River requires for Trenton sewage; (2) so far as reasonably possible every state health board should consider all the sanitary and public-health needs of a community before sanctioning the expenditure of money for any purpose on sanitary or public-health grounds, in order to make sure that money so spent would not yield larger and better results if devoted to some other purpose; (3) ground 2 is all the more important when a city submitting plans for sewage treatment is doing so under compulsion from the state board of health, which is true in the Trenton case to the extent of years of prodding by the board, sharpened and strengthened last year by a court order at the board's instance requiring Trenton to stop polluting the Delaware within eighteen months. This prodding and court order make the New Jersey State Board of Health a partner in placing the burden of sewage-works construction and operation on the taxpayers of Trenton. The board therefore should make sure that the burden is no heavier than local conditions demand, and rightly refuse to accept plans drawn to fulfil an idealistic conception of sewage treatment but providing, to meet that ideal, a method of disposal which the board regards as still in an experimental stage.

There are strong reasons for thinking that an investigation of Trenton's needs for various public improvements and for higher standards in some branches of its municipal service would produce returns of far more benefit to the citizens of Trenton than would result from the extra cost of sewage-works beyond sedimentation. To use only one illustration, and that in a field far more closely related to public health than sewage treatment: The latest annual survey of typhoid in the cities of the United States having a population of 100,000 or more showed Trenton with next to the highest typhoid death rate in 1922 of the cities in the list, being overtopped by Nashville only. This is a matter to which the city authorities of Trenton and the State Board of Health should give attention before plunging the city into heavy capital and operating charges for sewage treatment.

We are firmly convinced that a number of American state boards of health have made a serious error in their attempts to compel cities and towns to build sewage-works without first considering whether other sanitary works and more efficient local health department service should not come first. New Jersey, through its old State Sewerage Commission, its later State Board of Health and its present State Department of Health, has driven hard on sewage disposal, invoking the courts twice (Phillipsburg and Trenton cases) to compel cities to treat sewage, in both cases where nuisance rather than health was the only justification for action, but never, that we can recall asking the courts to compel a city to purify its water supply or take any well considered steps to cut down a high typhoid rate—like the 15.9 per 100,000 at Trenton in 1922.

Because of this misdirected past zeal—misdirected if relative sanitary and health values and the law of diminishing returns are weighed and balanced—the stand taken by the New Jersey State Board of Health in the Trenton sewage-works case is particularly gratifying. If the authorities, taxpayers and citizens of Trenton, with the aid and leadership of the local press, will perceive the significance of the denial of the Trenton sewage-works permit and act accordingly the dawn of a new municipal era in Trenton may soon appear. In any case the stand of the State Board of Health of New Jersey is commended to the attention of any board elsewhere which is acting on the principle that its jurisdiction over water and sewage treatment plans ends with judgment as to whether the plans will be sufficient instead of extending to their possible over-elaborateness and the city's needs for more vital improvements or services.

An Interview:

With HENRY W. HORST
President Henry W. Horst Co., General Contractors, Rock Island, Ill.

Business Methods in Highway Contracting

By C. S. HILL
Associate Editor Engineering News-Record

Procedure in Securing Contracts and in Conducting Construction Estimating, Planning and Cost Keeping Processes

HIGHWAY contracting is the business of producing specified road structures at a reasonable profit. It involves three broad activities: (1) Getting the contract; (2) planning and executing the work; and (3) accounting. These activities involve engineering, purchasing, maintaining and salvaging equipment, recording progress and performance, keeping and analyzing costs, developing personnel, and many subdivisions. All are essential elements of a *continuing business* which is the conception of contracting that must be held by any organization whose practice carries any useful lesson.

Organization Plan—The organization of this company is designed, as the chart, Fig. 1, shows, to carry on a general contracting business. Building construction and highway construction are the main activities and

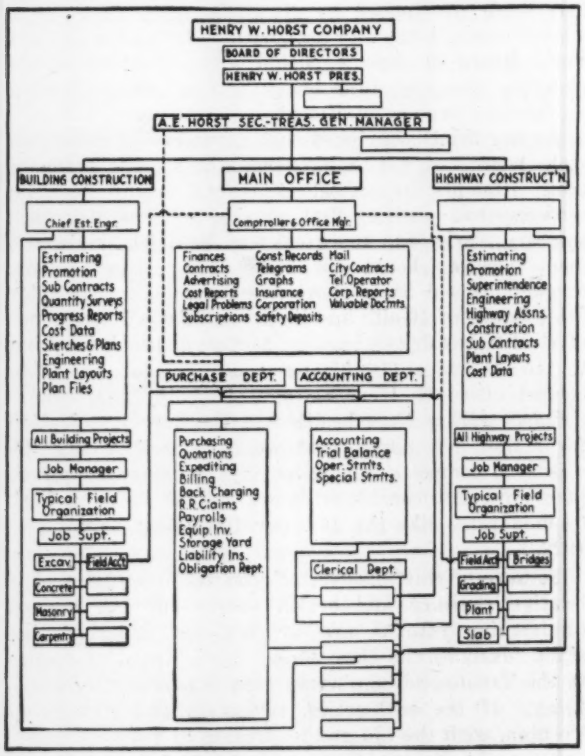


FIG. 1—ORGANIZATION CHART OF THE HENRY W. HORST CO., GENERAL CONTRACTORS

the organization plan provides that both shall be directed in about the same manner. There is a headquarters force having general direction of all projects and a field organization for each project or separate operation. Every activity not limited strictly to the locality of the job is a headquarters function. Accounting, purchasing, engineering and personnel work are specifically headquarters functions.

Accounting practice is a controlling operation and requires separate consideration. Purchasing involves not merely buying at the best prices and the clerical and accounting processes in connection, but getting transportation and delivery, checking quantities and quality, and storage and stockkeeping. Personnel work begins with clean and comfortable bunkhouses and good meals and extends to commissary stores, recreation buildings, and accident prevention. Fostering organization loyalty is vital and requires purpose and effort by the executives and department heads and it cannot be secured if these officials are indifferent. Engineering is the task of getting contracts and executing the work.

Headquarters planning does not mean that the field organization is without authority. Once the plans are determined and the field superintendent is on the work he is responsible and is not meddled with unless he fails in performance. His requisitions and reports keep headquarters in close touch and all its departments are at his service and, by the same token, all have an eye to the efficiency of his operations. He is the field executive under watchful and co-operative supervision by headquarters and relieved also by headquarters from all functions which are not specifically field activities.

Getting the Contract—Highways being public works, getting contracts calls for less personal promotion than when private works contracts are sought. It is important, however, to make every effort to get the record of the organization before the highway official, to impress on him the skill of its technical direction and the responsibility and integrity of its executive personnel—to sell the firm. Unless the bid is lowest, this selling effort does not land the contract but it helps to get the good will of the road official and when a contract is landed it eases all negotiations and establishes good relations from the beginning. Of course it goes without saying that the contractor by his work must bear out his professions of responsibility, skill and integrity.

Technical skill is an essential element in getting profitable contracts and as a general business proposition a contract which does not pay a profit is not worth getting. To be at all certain of a profit it has to be known what the work will cost. This requires close and intelligent estimates, and these are technical tasks and are the duty of the engineering department, drawing on the other departments, on the field superintendents and on the executive officers for help and advice.

Great detail and precision characterize the procedure of making a good estimate. The first step is a study of the plans and specifications; this cannot be a quick, perfunctory examination but must be a careful reading (a double reading is well) of every detail. Then the field of the operation requires intensive study to determine distances; sources of materials; transportation facilities; locations for unloading yards; plant sites; character of excavation; water supply; detour routes; local labor conditions, team supply and markets; living

accommodations, and other conditions that may affect the cost of the operation. Until this preliminary information is in hand, the work of estimating cannot be taken up intelligently.

It is helpful to precede itemized estimating with a total cost estimate based on a general unit, as mile of road or cubic foot of building, using costs on record representative of the work under consideration. A fairly accurate figure is thus obtained which is a guide to the estimator in his detail computations which now begin.

General expenses are first. It is best to use a list of all possible general expenses and cross out the items not entering into the cost of the work being estimated. Labor and material are then taken off for each item specified and are given prices as each item is considered. In pricing each item of work, the estimator needs to visualize the particular operation in the light of past experience and of his study of the plans and specifications and his field survey. Listing the items, determining the amounts and setting unit prices are the skilled processes of estimating. All others are calculating and checking operations.

Extensions and numerical calculations from the estimator's data are best made by one person and checked by a second. Every rule for numerical precision in such operations is followed. When calculations and summations are completed they are reviewed by the estimator who scrutinizes items and totals and makes any changes or corrections his judgment advises. An estimate of cost by parts is then made and compared with the general estimate. Finally the estimate and all data in connection go to the general manager and are reviewed by him in conference with the estimator. With the bid made and the contract secured an official estimate is made out for record and cost accounting purposes.

Estimating is of first consideration in contracting. Unless prices are right contracts will not be obtained and profits cannot be earned, and, without both, business cannot continue. To set right prices, costs must be known and accurate accounting and cost keeping are necessary to a knowledge of costs. Even with the best possible records of past costs, estimating future costs involves enough hazard to make neglect of careful accounting a positive danger. With experience and

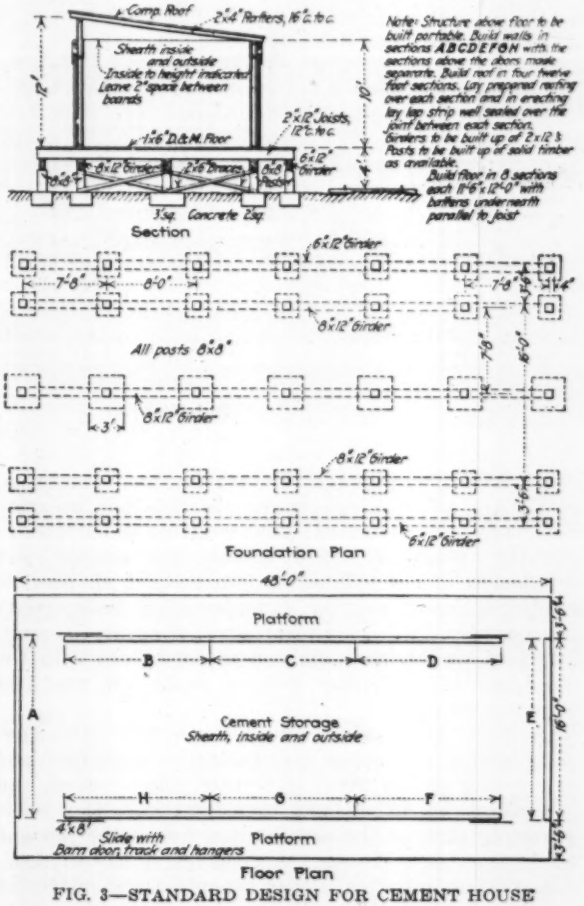

Comp. Roof
2"x4" Rafters, 16" c. to c.
Sheath inside and outside
Inside to height indicated
Leave 2" space between boards
2"x12" Joists, 12" c. to c.
1"x6" D. & M. Floor
6"x12" Girder
2"x8" Braces
6"x8" Posts
6"x12" Girder
3" Sq. Concrete Dwg.
Section
Note: Structure above floor to be built portable. Build walls in sections A B C D E F G H with the sections above the doors made separate. Build roof in four twelve foot sections. Lay prepared roofing over each section and in erecting lay lap strip well sealed over the joint between each section. Girders to be built up of 2"x12"s. Posts to be built up of solid timber as available. Build floor in 8 sections each 11'6"x12'-0" with battens underneath parallel to joist
6"x12" Girder
All posts 8"x8"
8"x12" Girder
Foundation Plan
48'-0"
Platform
Cement Storage
Sheath, inside and outside
4"x8"
Slide with Barn door, track and hangers
Platform
Floor Plan

FIG. 3—STANDARD DESIGN FOR CEMENT HOUSE

good judgment, vigilance in preventing omissions and a good record of previous costs, prices can be set which, with good management, will bring a profit and no less prices should ever consciously be made.

Planning and Execution—Good work is invariably planned work and planning is not an individual task but an organization task. With the preliminary field study notes (a second specific field study is made if necessary) and the information and plans provided by the highway department, a paper layout is made. The

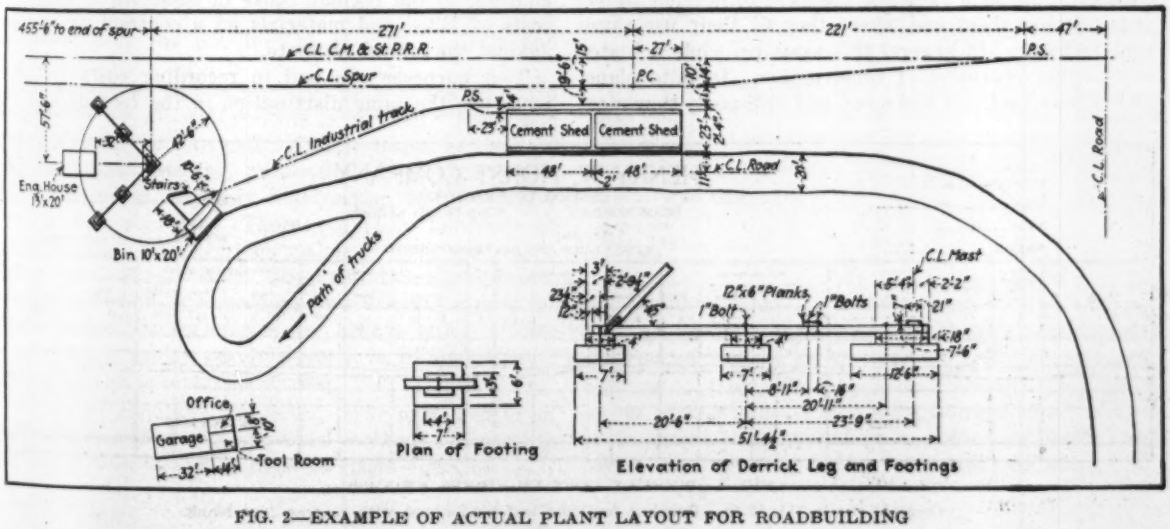


FIG. 2—EXAMPLE OF ACTUAL PLANT LAYOUT FOR ROADBUILDING

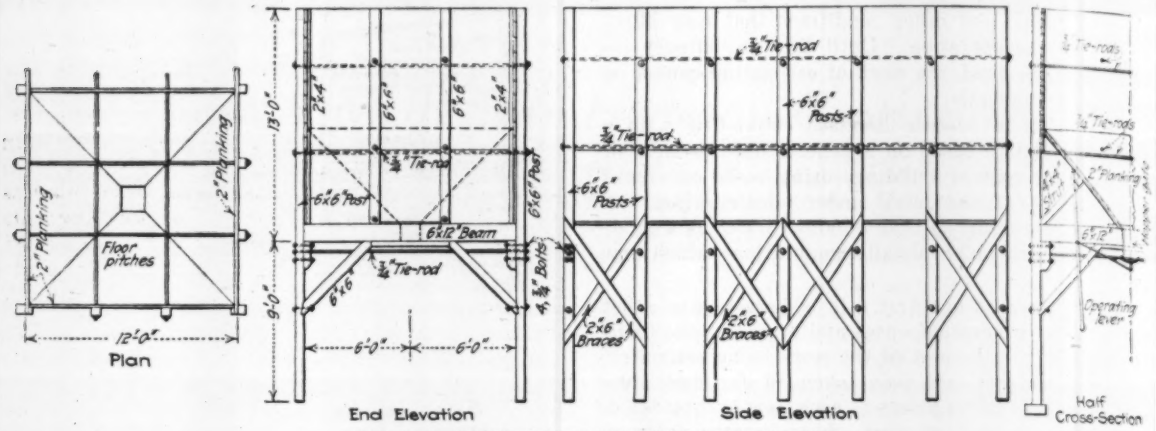


FIG. 4—STANDARD DESIGN FOR ELEVATED BINS

work is divided into sections; starting and completion dates are set; haulage routes are selected; progress schedules are determined; plant locations and shifts are decided; plant and yard layouts are planned and equipment is selected taking into account all possible contingencies of weather, transportation, labor, materials supply, etc. This planning is done by the engineers of the highway division in conference with the executive officers, other division heads and the field superintendents.

A co-ordinated plan results from this procedure. Engineering, financing, purchasing, construction and accounting are all fitted into their places. Stock and equipment on hand have consideration. The whole directing staff of the organization knows the job and each department knows the demands it has to meet. The field organization is then assembled and instructed in the plan and the parts they have to perform. In brief, work is undertaken according to a definite plan and every responsible head from the foreman up knows the plan and what he has to do to carry it out.

An actual plant layout is given by Fig. 2. It is not elaborate in detail but contains all the essential data for the field installation. So far as practicable standard plans are used for structures as the cement house, Fig. 3, and the elevated bins, Fig. 4. It should be noted, however, that there is no insistence on standard designs if the local conditions make other designs better or cheaper. The firm is not in business to develop standards. It has them and where they fit their use saves time and cost. In general this same principle actuates every other operation of construction. Definite plans, as has been said, are laid down and ordinarily they meet the situation, but if conditions develop which unfit the original plans for the work they are modified without hesitation if the gain is worth the expense. In brief it is not the intention to plan initiative and responsibility away from the field superintendent and his staff.

A typical field organization consists of a field superintendent, an accountant responsible to the general accountant, and foremen of grading, plant, concrete and bridges responsible to the superintendent. Generally there is a master mechanic, with crew, in charge of equipment maintenance and repair. The plant foreman is in charge of concrete production while the slab foreman directs concrete placing and finishing. If the job is one calling for commissary and bunkhouse service the organization is extended, but whatever its extension all division heads are responsible to the superintendent. He is the field executive.

Accounting—Definite dollars and cents information of details of operation are as essential in highway contracting as in any other business. Accounting for construction involves very particular attention to costs. In handling original records, banking, bills and vouchers, payrolls, collections, etc., the usual accounting procedure applies. The regular books of accounts used are: A combination cash book and control; contract, job work, creditors', customers' and general ledgers; and a construction record. The last book is kept in addition to the regular books of accounts to arrive at costs of labor and materials on a contract as checked against the official estimate.

Two purposes are had in recording costs. One is to secure the same distribution in the records and the

REPORT No._____
SHEET_____ OF_____
JOB No._____
JOB NAME_____

HENRY W. HORST COMPANY
GENERAL CONTRACTORS
HORST BUILDING ROCK ISLAND, ILLINOIS

DATE_____ 19__
Report for week ending_____ 19__
APPROVED_____

MATERIAL
WEEKLY LABOR COST AND PROGRESS REPORT

ACCOUNT NO.	DESCRIPTION	COST FOR PERIOD			CORR. COST FOR PERIOD			REF.	COST TO DATE			ESTIMATED COST TO DATE			GAIN	LOSS
		Amount	Progress	Unit	Amount	Progress	Unit		Amount	Progress	Unit	Amount	Progress	Unit		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	TOTALS											NET GAIN LOSS				

FIG. 5—WEEKLY COST PROGRESS REPORT

Original sheets 15½x13 in. Punched for loose-leaf binder and with reverse face blank.

original estimate so that comparison is possible. The other is to get cost-progress records which are closely concurrent with actual operations. From daily labor distribution is summarized a weekly cost and progress report to give the weekly profit or loss and the weekly cost to date. These reports are prepared in the field office and forwarded regularly to headquarters. Fig. 5 shows the form of the weekly cost-progress report. It is virtually a complete current cost record of the particular operation it covers.

Equipment—Attention to equipment costs is important. It is desirable to know not merely what the cost altogether of equipment is, but what each piece of major equipment costs. Minor equipment (costing less than $100 a unit) costs are lumped. A rental value and a depreciation charge are assigned to each permanent equipment unit and an account of its earnings is kept. Equipment is classified as plant for: (1) Excavation, rolling and grading, (2) unloading material, (3) hauling materials, (4) mixing and placing concrete, and (5) water supply; and accounts are kept separately for permanent and temporary units covering repairs, erection, fuel, light and power, and general expenses. Generally speaking, a financial and service history of each equipment unit is sought.

Equipment requires close supervision. It represents a large investment and the rate of depreciation is rapid. Good maintenance when working, safe storage and protection when not working, and close calculation to keep the periods of idleness few and short are absolute requirements in managing equipment. Watchfulness is aided by individual records, for no unit can be laid up long, with depreciation charges mounting and no rental coming in, without the fact being noted and steps being taken to get the machine assigned to work, or rented out or disposed of by sale or exchange. Salvage is another important operation. Lumber and other materials, small tools and supplies, and scrap metal are collected and put in shape for further use or for subsequent sale.

Construction accounts properly kept are working tools. They are used to estimate future costs in making bids, to check the efficiency of work in progress and to guide the selection and management of equipment. Analysis, comparison and combination of the original records are essential to the fullest use of cost records. The discussion of motor truck haulage by A. E. Horst in *Engineering News-Record*, April 12, 1923, p. 658, is an example of the possibilities of such analysis and combination.

As an aid in accounting and to indicate standard procedures by all departments a printed "Field and Office Manual" is provided. This contains sections on engineering, accounting, purchasing, field office, building construction, highway construction and forms for records and accounts. There are some hundreds of pages in this manual, which makes obvious the reason for not presenting details. They may be quite different to suit different organizations and varying classes of work but general principles are always true. Unless contracting is made a real business it is, in the long run, bound to be only a partial success.

(The next article in the series, to be published in an early issue, will explain approved methods of carrying on winter construction of concrete roads.—EDITOR.

Road Maintenance and Traffic Counts

BY H. G. HOTCHKISS, JR.
Former Deputy Commissioner of Highways, Albany, N. Y.

A TRAFFIC census has been taken at least every other year for a number of years by the New York State Highway Commission. The counts have been made during August at representative points on various routes throughout the state to show the amount and class of traffic for 12 hours from 7 a.m. to 7 p.m. The counts show, as might be anticipated, that traffic has increased tremendously between 1909 and 1922 and that the horse traffic has decreased to less than 2 per cent; and that bus and truck traffic has increased 225 per cent in 5 years.

AVERAGE COST OF MAINTENANCE OF VARIOUS TYPES OF PAVEMENT, CLASSIFIED AS TO THE AMOUNT OF TRAFFIC
(1908 to 1922 Inclusive)

Vehicles per 12-Hour Day	Miles Maintained	Cost per Mile per Year Pavement Only	Total Cost
Gravel Waterbound Pavement			
Less than 500	110.76	$584	$737
500 to 1,000	31.49	721	924
1,000 to 2,000	6.62	675	872
Over 2,000	0.60	824	983
Total	149.47 Average	$622	$785
Waterbound Macadam			
Less than 500	1,111.72	$551	$658
500 to 1,000	763.26	652	843
1,000 to 2,000	360.12	692	897
Over 2,000	38.51	881	1,110
Total	2,283.61 Average	$615	$766
Bituminous Macadam Penetration Method			
Less than 500	947.41	$303	$429
500 to 1,000	1,050.61	355	499
1,000 to 2,000	798.03	409	612
Over 2,000	317.09	646	889
Total	3,113.14 Average	$382	$547
Bituminous Macadam Mixing Method on Macadam Base			
Less than 500	12.87	$375	$473
500 to 1,000	5.90	513	612
1,000 to 2,000	7.48	302	484
Over 2,000	17.89	544	913
Total	44.14 Average	$449	$673
Bituminous Macadam Mixing Method on Concrete Base			
Less than 500	7.66	$ 99	$300
500 to 1,000	22.65	146	231
1,000 to 2,000	30.39	146	298
Over 2,000	29.02	229	336
Total	89.72 Average	$169	$293
Hassam Pavement and Second Class Concrete			
Less than 500	47.79	$532	$759
500 to 1,000	84.71	495	675
1,000 to 2,000	57.97	545	768
Over 2,000	21.88	472	728
Total	212.35 Average	$517	$724
Brick Pavement			
Less than 500	31.35	$165	$414
500 to 1,000	64.33	99	199
1,000 to 2,000	62.69	109	219
Over 2,000	87.77	279	493
Total	246.14 Average	$174	$337
First-Class Concrete Pavement (1:2:4 Mix or Better)			
Less than 500	114.61	$ 62	$172
500 to 1,000	158.28	54	152
1,000 to 2,000	199.46	76	226
Over 2,000	98.28	149	402
Total	570.63 Average	$80	$230
Total of above types:			
Less than 500	2,384.17	$422	$543
500 to 1,000	2,181.23	438	595
1,000 to 2,000	1,522.76	422	618
Over 2,000	611.04	495	735
Total	6,699.20 Average	$433	$595

In reviewing this change and development in traffic the cost of upkeep on the various types of pavement relative to the traffic has been checked. This check covers 6,699.2 miles, which were segregated as to type of pavement and grouped as to volume of traffic, and covers the five-year period, 1918 to 1922 inclusive.

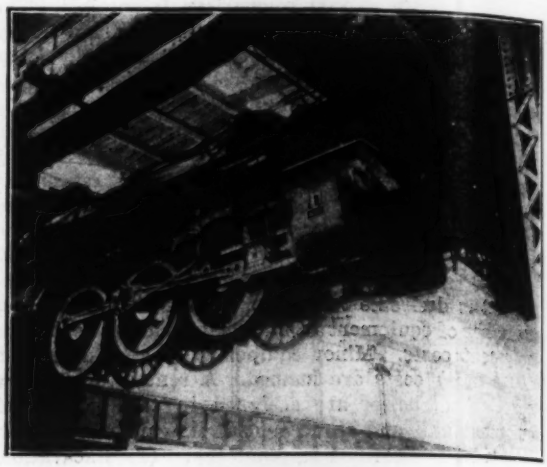
Erie Improves Its Erecting Shops at Hornell, N. Y.

Large Gap Type Locomotive Handling Crane Makes Transfer Table Unnecessary and Speeds Up the Engine Movements

TO IMPROVE the layout and to increase the capacity of its transverse locomotive erecting shop at Hornell, N. Y., the Erie Railroad Co. has resorted to a novel arrangement of traveling cranes.

The present seven-pit erecting shop is being enlarged by a nineteen-pit extension, the ten pits in the machine shop and the transfer table that served both shops are to be done away with, and all locomotive handling facilities concentrated in the enlarged erecting shop. The present 120-ton traveling crane is to be replaced by one 250-ton, 8-motor, double-trolley, gap type locomotive handling crane which will operate over the entire length of the enlarged twenty-six pit shop. Each trolley of the gap type crane has a capacity of 125 tons and has an auxiliary hoist of 15 tons capacity. The large crane is to be supplemented by two 15-ton electric traveling cranes which, contrary to the usual practice, will operate above it.

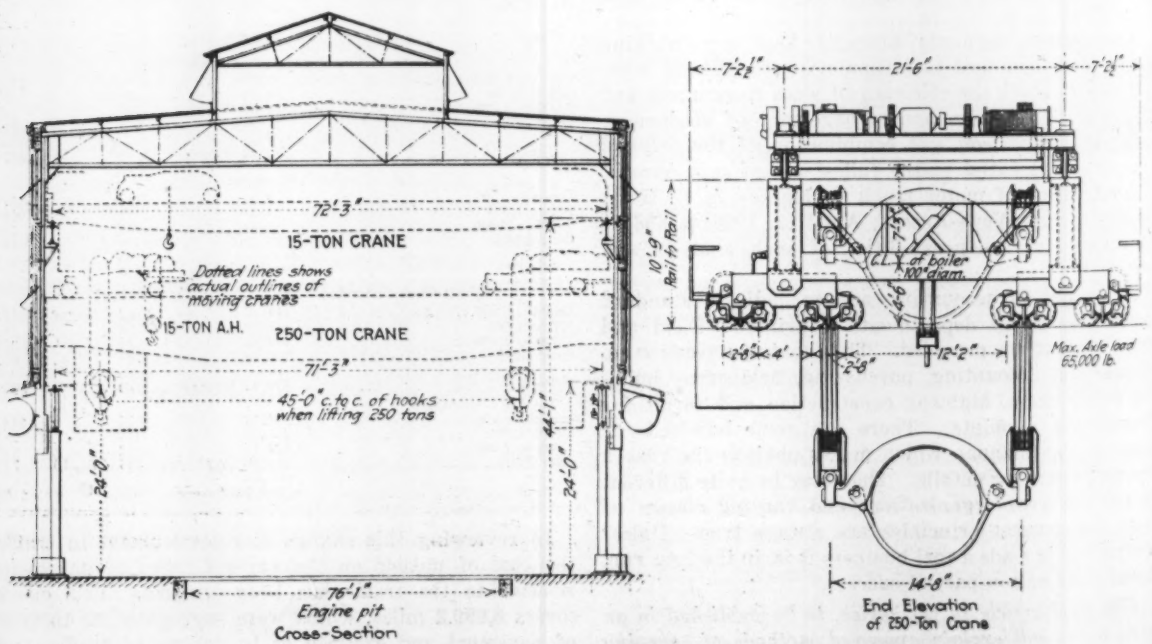
The old shop was originally designed for a 120-ton crane operating with the rail 40 ft. above the floor level. Later the crane runways and columns were reinforced so that they would carry two 150-ton cranes. In the new shop the crane runway is designed for a 250-ton gap crane operating with the rail 24 ft. above the floor level. At this level the gap crane gives locomotives lift-over service the same as the one in the old shop with the runway 40 ft. above the floor. In both the new and the old shops the column spacing is 21 ft. It is planned to change the runways and columns in the section of the old shops so that the 250-ton gap crane will be used in both new and old buildings. Very careful analysis of



LOCOMOTIVE RAISED FOR TRANSVERSE MOVEMENT
The relative position of the two crane runways is shown on the columns in the background.

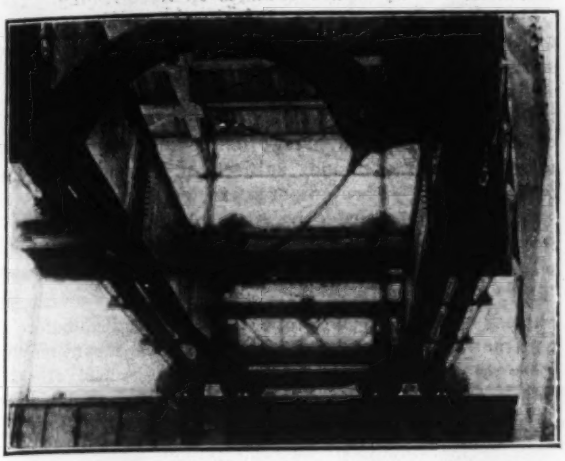
the columns and runways in the old building showed that the columns could be cut to place the craneway at the 24 ft. level without reinforcing the section in any way, and that the crane girder as originally designed and later reinforced for a 150-ton crane, was sufficient for the 250-ton crane load. This was due to the fact that the wheelbase on the 250-ton crane was 10 ft. greater than on the 150-ton crane. The requirements of the shorter column were such as to make them ample for the 250-ton crane load.

The advantages of this new layout, other than the increase in the area of the machine shop and the elimination of the transfer table, are twofold. In the first place the use of a gap type locomotive handling crane results in a considerable economy in the structural steel



CROSS-SECTION OF THE NEW ERECTING SHOP

required for the columns supporting the crane runway due to the reduction in the necessary height of such a runway as compared with the height of runway for a suspended type crane. Also, as the new crane will be able to lift the heaviest engines in the Erie service, drop pits will no longer be necessary. In the second place the advantages from an operating viewpoint are that with the small cranes operating above the large crane, materials can be moved from end to end of the shop without interfering with the operation of the large crane. The use of the traveling crane in place of the transfer



GENERAL VIEW OF THE GAP TYPE CRANE

Showing in the foreground the boiler sling of the forward trolley, and in the background the two main hoists of the rear trolley and the 15-ton auxiliary hoist.

table for all engine movements will reduce the time required for this operation from 38½ min. to 4½ min.

The work is being done under the direction of C. H. Splitstone, superintendent of construction and surveys, Erie R.R. Co., New York City.

Mechanical Agitation for Sewage Activation Plant at Wakefield, England

Plans for an activated-sludge plant making use of paddles instead of compressed air for agitating the sewage of Wakefield, England, have been approved by the Ministry of Health, and construction has been started. The town has been authorized to borrow £15,000 for extending and remodeling its Agbrigg plant, at which the activated-sludge process will be installed. The plans have been adopted on the recommendation of John Haworth, general manager of the sewage-works of Sheffield. Mr. Haworth terms this a "bio-aeration" method of sewage treatment. According to the London *Surveyor*, "two screening and heavy gritting chambers" will be placed at the end of the outfall sewer. Each of the chambers will be "provided with a power-driven screen and mechanical grit elevator, and four preliminary settling tanks, storm overflow weir, one aeration tank (in two compartments), sixteen paddle wheels, main driving shaft and paddle power house containing worm reduction gears and motors." At the end of the aeration tank there will be installed "four vertical-spindle electrically-driven centrifugal pumps" for lifting "the sewage and activated-sludge" to four Dortmund settling tanks. The activated sludge will be delivered to eight sludge drying beds.

Engineers Engaged in Highway Work

FROM a recent questionnaire sent to all state highway departments by the employment department of the American Association of Engineers, it was learned that (excluding Pennsylvania) 7,046 engineers are on the various staffs. North Carolina has 800, New York 700, Illinois 534, Missouri 500, California 424, Iowa, 250, West Virginia 242, Oregon 240, Virginia 200, Kentucky 200, Wisconsin 180 and Michigan 175. More than 2,000 additional engineers are needed for this season's program which will total $352,000,000, not including Michigan, Pennsylvania and South Carolina, whose programs for highway work had not yet been completely formulated.

ENGINEERS ON STATE HIGHWAY WORK, AND MONEY INVOLVED IN 1923 EXPENDITURES

States	Engineers on Highway Staff	Approximate Expenditure for Road Work
Alabama	102	$3,500,000
Arizona	60	6,000,000
Arkansas	15	10,000,000
California	424	12,000,000
Colorado	60	5,000,000
Connecticut	25	1,000,000
Delaware	66	2,500,000
Florida	65	3,500,000
Georgia	77	3,500,000
Idaho	31	2,000,000
Illinois	534	30,000,000
Indiana	117	7,500,000
Iowa	250	10,000,000
Kansas	40	3,000,000
Kentucky	200	6,000,000
Louisiana	76	7,000,000
Maine	31	2,190,000
Maryland	115	3,450,000
Mass	240	9,000,000
Michigan	175	App. pending
Minnesota	105	10,000,000
Mississippi	58	4,000,000
Missouri	500	2,500,000
Montana	47	2,100,000
Nebraska	60	2,000,000
Nevada	85	2,500,000
New Hampshire	37	2,500,000
New Jersey	136	16,000,000
New Mexico	100	3,500,000
New York	700	35,000,000
North Carolina	800	15,000,000
North Dakota	40	2,000,000
Ohio	50	20,000,000
Oklahoma	60	8,000,000
Oregon	240	10,000,000
Pennsylvania	...	...
Rhode Island	44	2,500,000
South Carolina	135	...
South Dakota	80	4,000,000
Tennessee	54	7,300,000
Texas	33	26,000,000
Utah	55	2,000,000
Vermont	32	2,000,000
Virginia	200	8,000,000
Washington	100	4,500,000
West Virginia	242	12,000,000
Wisconsin	180	20,000,000
Wyoming	70	2,500,000
Total	7,046	$352,040,000

The average turnover of personnel for a year is 44 per cent with a maximum of 140 per cent in California and minimum of 3 per cent in New Hampshire. Wisconsin had 130 per cent, Washington 105 per cent, Rhode Island 102 per cent, Pennsylvania, Oregon and Iowa 100 per cent each. In several states wholesale discharge of nearly the whole staff of the department has taken place for political reasons. In Arizona, for instance, after a change in administration, 90 per cent of the 1,200 men were either ousted or quit. Idaho has had a similar experience. In five states applicants must be residents while in ten the state prefers its own citizens.

The remainder (with the exception of Pennsylvania which did not reply to this question) indicate no discrimination against non-residents.

Cantilever Highway Bridge Across the Ohio at Ironton

Main Span of New Toll Bridge Is 725 Ft. and Anchor Arms 350 Ft. Each—Was Locally Financed—Rapid Progress Made in Construction—Hydraulic Jacks Assist Erection

By J. F. Jackson
Consulting Engineer, Milwaukee, Wis.

UNUSUAL CONDITIONS OF PROMOTION and financing were necessary preliminaries to the construction of the new Ohio River cantilever bridge between Ironton, Ohio, and Russell, Ky., which was opened in April, 1922, and a view of which is shown in Fig. 1. The city of Ironton has a population of 14,000. Russell is very much smaller, but is an important division point on the Chesapeake & Ohio Ry., and many railway employees live in Ironton. Ferry traffic has been heavy for several years and there was need of a highway bridge to afford adequate transportation facilities. How to get the project financed was a problem in human engineering, a problem of a kind which is too seldom mentioned in articles on engineering work. Briefly, public interest was awakened, plans and estimates were secured, a local company with 2,600 stockholders was organized, passage of a bill by Congress was secured, a permit from the War Department was obtained, and a contract was let, all in nine months.

In September, 1920, when the Chamber of Commerce at Ironton decided to investigate the bridge problem, E. B. Adams, the secretary, wrote to twenty-three bridge companies and engineering firms explaining the situation and stating that local interests could finance a project of about $700,000. As an outcome of the negotiations, after eliminating unsatisfactory replies and negotiating with two or three prominent bridge companies, the bridge committee of the Chamber of Commerce finally authorized the Wisconsin Bridge & Iron Co., Milwaukee, Wis., to determine the best location and to prepare plans, specifications and estimates. At this point the writer was engaged by the company for consultation on the work. It must be remembered that before organizing a company or obtaining a charter the bridge committee wanted to know if the project was feasible and what would be the cost. Speedy work was necessary so that foundation work could be begun and completed during the approaching low-water season.

Upon the completion of general plans and estimates the cost was found to be higher than the amount the bridge committee thought could be raised. This matter was adjusted by changing several hundred feet of the more or less temporary approaches to timber construction and by minor changes in hand-railing. The Ohio approach viaduct extends to the anchor pier, but at the Kentucky end there is a 200-ft. through-truss span between the anchor pier and viaduct approach.

An estimate having been made, the bridge committee initiated a campaign to sell stock in a company to be organized to build a bridge on definite plans and for a definite sum of money subject, of course, to various contingencies. Through organizing ability and public spirit $778,000 were subscribed by 2,600 stockholders in about three weeks. The Ironton & Russell Bridge Co. was then organized, with E. J. Merrill as president and E. B. Adams as secretary. There remained an almost endless amount of red tape to be untangled before a contract could be entered into, but in the meantime the Wisconsin Bridge & Iron Co. was authorized to make the necessary surveys, maps and plans required by the U. S. Government and to do other engineering work in connection with the project. The authorization to construct the bridge was signed by the Secretary of War on June 29, 1921. A contract having been entered into with the Wisconsin Bridge & Iron Co., work on the bridge was started without delay.

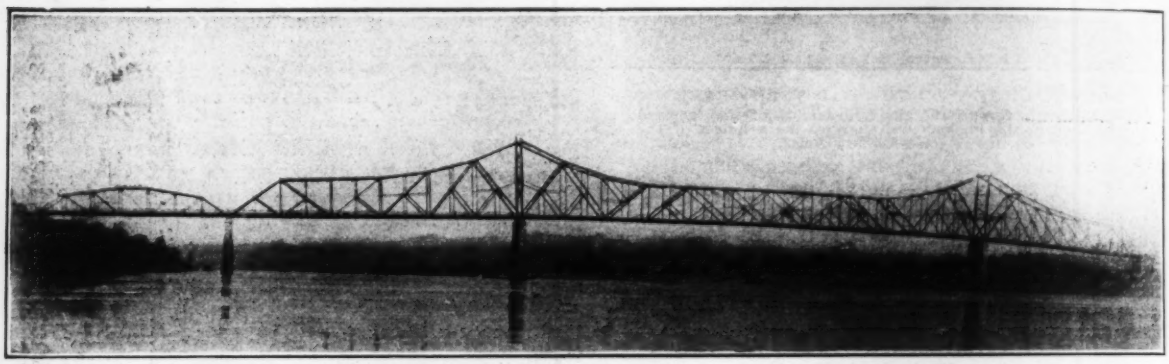


FIG. 1—HIGHWAY BRIDGE OVER OHIO RIVER AT IRONTON, OHIO; 725-FT. CANTILEVER SPAN

Piers—The first step was the construction of the four river piers, the contract for which was let to the Dravo Construction Co., Pittsburgh, Pa., on July 25, 1921. There were some interruptions by sudden rises of the river, but the work was finished Oct. 26, 1921, just ahead of high water. Fig. 2 shows one of the main river piers, each of which contains about 2,500 cu.yd. of concrete. The use of two shafts connected by a reinforced web for the upper part of piers was a means of saving concrete, or rather placing the bulk of concrete where it would do the most good, as compared with the more usual rectangular plan of piers. The exact depth to solid sandstone was not known and could not be determined by the time estimates were demanded, but our assumed depths of 8 to 9 ft. below low-water proved to be fairly correct.

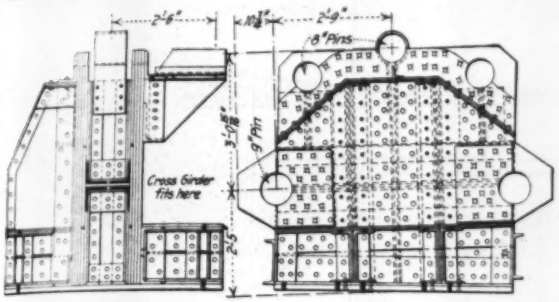


FIG. 3—BEARING SHOE WITH FIVE PIN CONNECTIONS

General Location and Layout—The Ohio River at this point is about 1,000 ft. wide at low water, with banks about 1,600 ft. apart at 50 to 55 ft. above low water. A clearance of 40 ft. above high water was required over the navigation channel. The stage of water is subject to great and sudden variation, and the floods of 1885 and 1913 rose 65 ft. above low water. A location crossing the river nearly at right angles was adopted, with grades of 4 per cent on the approaches and shore spans. Determination of the general character of the structure was the next step, giving span lengths and pier locations which would be approved by the government engineers and by river transportation companies. Other bridges on the river have spans of 500 to 775 ft. and the new dams have navigation passes 700 ft. in width.

For preliminary studies, contour maps of the river bottom were made and floats were sent downstream, their direction and speed being shown on the maps. The low-water navigation channel lies near to the north shore and this determined the location of the north pier within close limits. Since there is a fairly straight river channel from two miles above to half a mile below the bridge site, it was believed that we could get approval of a center span 700 ft. in the clear or 725 ft. c. to c. of piers. Further study showed that a good looking and economical layout could be obtained by a symmetrical cantilever of 1,425 ft. total length, with 4 per cent grades on the anchor arms and the adjacent 200-ft. shore spans (see *Engineering News-Record*, Oct. 13, 1921, p. 613).

Live-Loads for Design—Determination of live-load and design of the floor system was the next step, and it was considered advisable to provide for possible future electric railway traffic. Railway bridges are often kept in service long after their design loads are exceeded. A short highway span may sometimes have to carry the live-load for which it was designed. In fact since the advent of heavy trucks and road rollers, the suspenders, floorbeams and especially the floor stringers of old highway spans are apt to be exceedingly light and shaky. The use of short panels and light stringers, which are a source of vibration and injury to the floor itself, whether it be of wood or concrete, is a serious fault still committed in many recent structures, short and long. In the Ironton bridge the panels are 29 ft. 2 in. on the anchor span and cantilever arms, and 31 ft. 3 in. on the suspended span. This long panel design with deep stringers has resulted in a very rigid floor system of great local load capacity and a truss of more than adequate strength and absolutely without any skinny or shaky members.

The bridge was proportioned for the following loads, the live-load being assumed to move across the bridge in either direction for position of maximum stress in each member:

1. Full dead-load including all steelwork and wood floor-figuring lumber at 4½ lb. per foot board measure.

2. Live-loads for floor members and primary truss members based on a maximum combination of the following loads over a space the full width of the roadway and sidewalk for a length of 90 ft.: (A) A concentrated load of two 45-ton street cars on the 10-ft. space next to sidewalk; (B) a load of 30 tons uniformly distributed over the remaining 16 ft. of roadway and sidewalk to cover trucks, automobiles, wagons and foot passengers; (C) an 18-ton road roller placed anywhere on the roadway.

3. Live-load for main web members same as above, preceded or followed by a uniform load of 800 lb. per lineal foot.

4. Live-load for main chords; 1,400 lb. per lineal foot.

5. Wind forces were taken at 500 lb. per lineal foot moving, 350 lb. on bottom laterals and 150 lb. on top laterals.

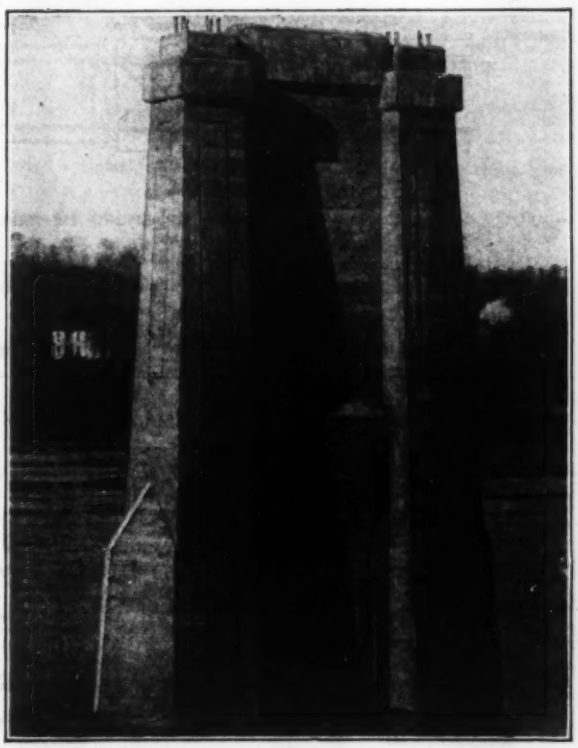


FIG. 2—DUMBBELL PIER OF OHIO RIVER BRIDGE
In the upper part the web is 36 in. thick and the shafts are about 8½ ft. square.

Design of Bridge—The cantilever trusses are spaced 29 ft. c. to c., giving room inside for a 20-ft. roadway and a 6-ft. walk. Anchor spans are 350 ft. each, cantilever arms 175 ft. each, and the suspended span 375 ft., making a total length of 1,425 ft. The truss depth is 100 ft. at the towers, 50 ft. in the suspended span and 45 ft. at the shore ends of the anchor arms. The total weight of steel in trusses and floor system is about 2,100 tons.

Some novel ideas and important matters of detail embodied in this bridge should be mentioned. In order to reduce the amount of field riveting, to facilitate erection and to avoid secondary stress, the vertical post, bottom chords and inclined end posts are connected to

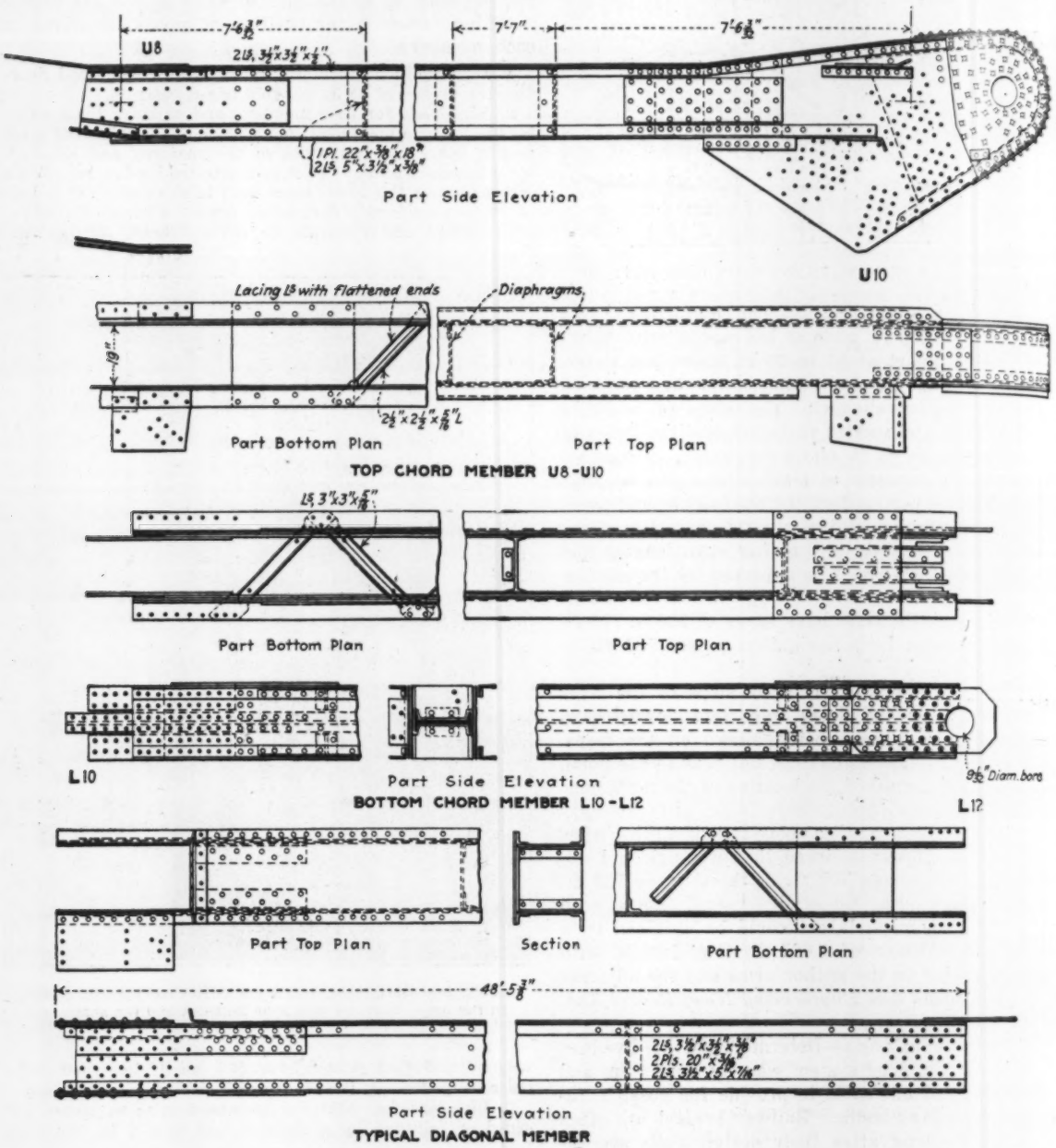


FIG. 4—TYPICAL TRUSS MEMBERS OF ANCHOR ARMS

the main bearing shoes by five pins, as shown in Fig. 3. Pins are also used at top of vertical posts and at top of inclined end posts for the same reasons. The rest of the structure is riveted. Typical truss members are shown in Fig. 4.

Particular attention is called to the numerous diaphragms in heavy compression members. In the chords and end posts these diaphragms are spaced about 7 ft. 3 in. on centers, and are used in H-sections as well as in ordinary box sections. Some use of diaphragms was also made in long tension members made of two 12-in. or 15-in. channels. Note may be made of the use of 3 x 3 x ⅜-in. single-intersection angle lacing on heavy members. The ends of the angles are flattened out and connected with three rivets, as shown. A more effective use of material for column lacing would be hard to find. Some smaller flattened angles having only two rivets at each end were also used. These lacing angles were also connected to batten plates at ends of truss members. Where cover plates formed part of the section on compression members these cover plates were tied in to the plates forming the riveted joint by means of angles, so that the cover plates could be counted on to carry their share of the load.

Long truss members of unusual stiffness resulted from the consistent application of the principles outlined above. There was no need to handle them "tenderly" in shop or field. This fact inspired confidence and pride on the part of shop and field workmen and speaks for itself in the completed structure. Some excess of metal was used at various points, such as cover plates on end posts and top chords of anchor arms, pri-

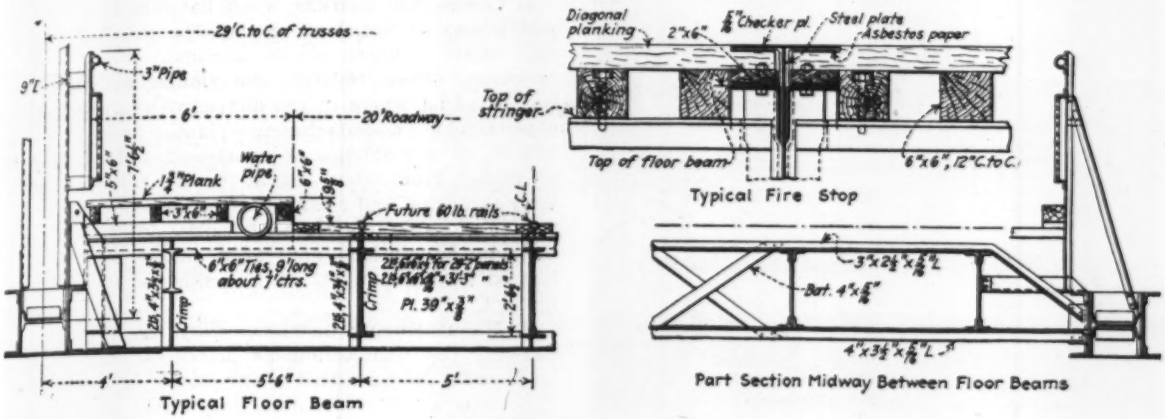


FIG. 5—FLOOR FRAMING AND TIMBER DECK

marily for the sake of appearance, but on the whole the metal is placed where it will do the most good, keeping in mind great load-carrying capacity, stiffness, ease of maintenance, and long life of the bridge.

Floor—In the floor construction, shown in Fig. 5, the 10 x 3-in. oak plank were sized, shiplapped ½ in. and laid diagonally on 6 x 6-in. yellow pine cross-ties spaced 6 in. apart. These ties were painted with creosote and the tops covered with strips of tar felt. This construction provides for future installation of an interurban track and makes a floor of great strength. It will dry out readily after rains and so prevent rot. The sidewalk floor is of 2-in. pine.

Cross-ties are supported on the four deep stringers and one 15-in. I-beam under the walk, as shown. The five stringers are tied together at their centers and to the bottom chords by a cross strut. The long bottom laterals are also connected to the bottom flanges of stringers. No vibration can get a start in construction such as this, which is designed to carry heavy street cars and road rollers. Fire stops of steel extending entirely through the floor are spaced 175 ft. apart.

Erection—Some special points may be noted in connection with the erection of the steelwork. Materials were delivered by rail on each side of the river, as required. It will be seen from Fig. 7 that the anchor arms, 350 ft. long, were each supported by three heavy steel bents on small concrete piers. These falsework bents, as well as the truss members, were raised by means of stiffleg derricks of 12 tons capacity with booms 95 ft. long. Booms were provided with a 20-ft. extension of about 3 tons capacity. These derricks traveled inside the trusses and were fastened to each successive floor beam as the work progressed. The boom could be turned backward between stifflegs in order to put in top lateral bracing.

After the completion of the anchor arms and cantilever arms, each half of the 375-ft. suspended span was built out in the usual way from the suspension points to a junction at the center. The projection over the main piers was 362½ ft. The work was done in March and some rather high winds were experienced, but the cantilever was so stiff and steady that no anxiety was felt by the erection men. For the first time in cantilever erection hydraulic jacks instead of wedges were used to control the position of bottom chords at suspension points, as shown in Fig. 6. Each jack was of 500 tons capacity. Each forward movement of the jack was followed up by shins. These jacks worked like a charm and were not expensive. The toggle joints in the top chord were operated by 125-ton hydraulic jacks arranged to produce a pull downward.

To further facilitate the connection of bottom chords at the center of the suspended span, links formed of pin plates about 6 ft. long and having slotted holes with the slot 2½ in. longer than the diameter of the pins were used. The pins and links were of sufficient size to take the dead load. After the suspended span was swung the pin plates were reamed and riveted to take up the live-load tension.

The bridge was built in 274 days counting from the time ground was broken for piers until the bridge was opened for traffic, April 23, 1922. Great credit is due the organization of the Wisconsin Bridge & Iron Co. for the high-grade work of its engineering, shop and erection departments. The Dravo Construction Co. did

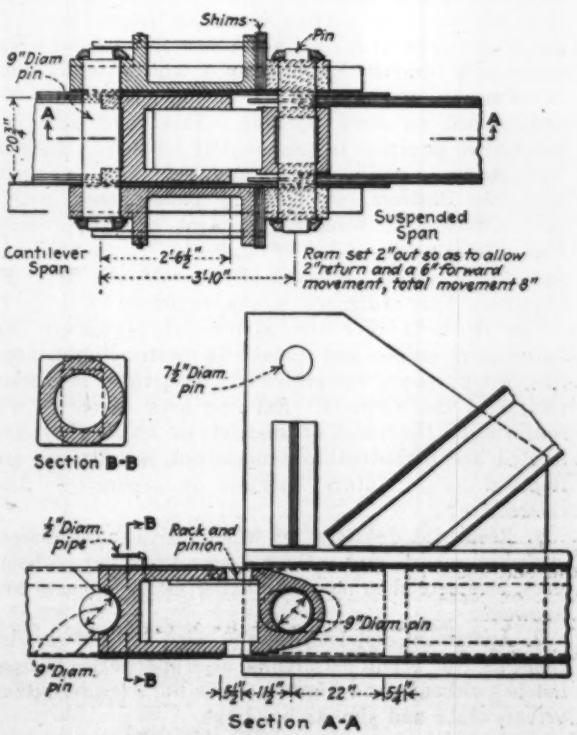


FIG. 6—HYDRAULIC JACK FOR CHORD CONNECTION

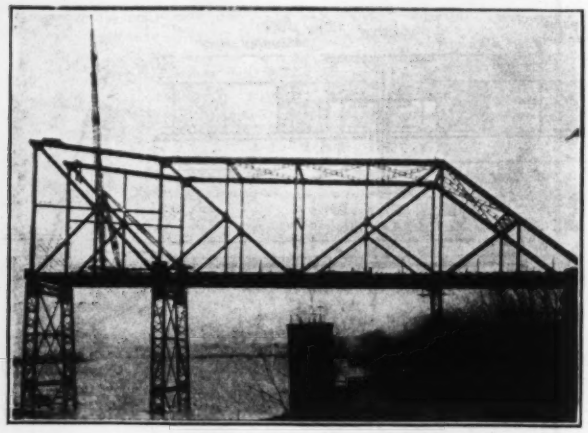


FIG. 7—ERECTING ANCHOR ARM ON STEEL FALSEWORK

rapid and splendid work on the substructure, as noted above. The engineers chiefly responsible for the design of general plans and details of this cantilever believe that it shows some rational advance in the art of assembling materials into a large-span highway bridge to meet all possible or probable needs of the future as far as they may be foreseen.

Chicago Adopts Zoning Ordinance for Entire City

Four Classes of Use and Five of Volume Districts—Control by Building Commissioner and Board of Appeals

A ZONING commission for the city of Chicago was appointed by the mayor in July, 1921, in accordance with a law passed by the Illinois legislature in June of that year. After numerous public hearings and conferences with civic and other organizations the commission drafted an ordinance which, with some amendments, was adopted by unanimous vote of the city council on April 5, 1923. This commission of twenty-two members is composed of municipal officials, business men, engineers and architects; its chairman is Charles Bostrom, city building commissioner; secretary, Charles H. Wacker, president of the Chicago Plan Commission; chief of staff, H. T. Frost; consultants in zoning, Edward H. Bennett and Wm. E. Parsons. This ordinance is now in force.

Use Districts—For the purpose of regulating the location of trades and industries and buildings for specified purposes, the entire city is divided into four classes of use districts. Existing uses which do not conform to the class of district in which they are located are permitted to remain but restrictions are imposed as to future changes or expansion. The classes are:

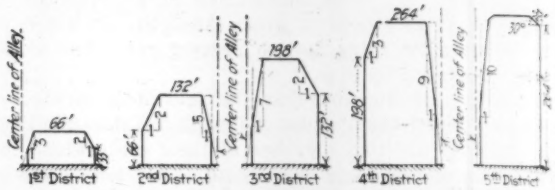
1. Residence districts, in which private residences, churches, schools and parks are permitted, but no business, commercial or manufacturing establishments are allowed.

2. Apartment districts, for the same use and restrictions as No. 1 but permitting also apartment houses, hotels (without store fronts), public libraries, hospitals, private clubs and similar buildings.

3. Commercial districts, which have the same use and restrictions as Nos. 1 and 2, but other regulations are: (a) retail business places, garages, offices, storage buildings, banks, theaters and similar activities may be located anywhere in the district; (b) light and unobjectionable manufacturing plants located within 125 ft. of a residence or apartment district may be prevented from operating at night; (c) such activities as dyeing and cleaning establishments, large food products manufactures, coal yards, ice plants, milk distributing stations and large stables must not be located within 125 ft. of a residence or apartment district.

4. Manufacturing districts, which are regulated as follows: (a) unobjectionable activities, even if on a large scale, are permitted in any part of such a district; (b) those which create dust, gas, smoke, noise, fumes, or odors must be at least 400 ft. from a residence or apartment district; (c) nuisance types of activities such as fertilizer, glue, cement and starch manufacturing, petroleum refining and tanning must be at least 2,000 ft. distant from a residence or apartment district.

Volume Districts—For regulating the heights of buildings and the percentage of lot area that may be occupied by a building, five classes of volume districts have been adopted, with restrictions as shown in the accompanying table. These districts are classified as follows: (1) areas devoted to private residences, two-flat buildings and similar uses where existing buildings have ample yard space and do not cover a large proportion of the yard area; (2) where the tendency is towards three-story apartment buildings; (3) where the tendency is toward tall apartment buildings and apartment hotels; also business and manufacturing sections outside of the central district; (4) warehouse and office buildings in sections close to the central district; (5) downtown district.



NEW BUILDING HEIGHT LIMITS FOR CITY OF CHICAGO

Diagrams for the five volume districts. Dotted lines indicate the alley building line for 55 ft. nearest to street intersection.

Height of Buildings—The limits of height for different classes of buildings are shown by the table and graphically in the accompanying diagram. Buildings are required to set back from the street lines and alley lines above certain heights, so as to provide for adequate light in the streets and for adequate light and air along the rear and sides of high buildings. Church spires are not included in these regulations, nor does the ordinance prevent the erection of grain elevators, gas holders or similar structures in excess of the prescribed limits of height and volume. When a building in a volume district No. 2, 3, or 4 fronts on a park or other open space or upon a street more than 120 ft. wide, the height of street front may be increased 33⅓ per cent of the height specified for such building in the ordinance.

Tests Show Differences Between Clay and Concrete Brick

Concrete Brick Piers Prove Stronger in Proportion to Individual Brick Strength Than Clay Brick Piers

EXTENDED tests into the comparative value of clay, sand-lime and concrete brick masonry have been made by the testing laboratories of the Department of Civil Engineering of Columbia University, under the direction of Prof. Albin H. Beyer and William J. Krefeld of that department. The tests are published in Bulletin No. 2 of the Department of Civil Engineering, Columbia University. According to that report the investigation indicates (1) the ratio between the compressive strength of masonry and the compressive strength of brick varies with the kind of brick even when the compressive and transverse strengths of the brick are the same and all other variables are maintained constant; (2) the ratio between the elastic limit and the ultimate strength of masonry varies with the kind of brick in otherwise similar masonry; (3) the loss of strength with heights of pier is not the same in masonry composed of different kinds of brick.

Tests were made on three kinds of common building brick, clay, sand-lime and concrete, and the selection of the material and the tests were both made with the co-operation of the Bureau of Buildings of the City of New York. In all, 135 masonry piers were tested, all 12 in. square. Of these 115 were 40 in. high, 20 were 84 in. high. In building the piers an effort was made to secure uniformity in bonding, quality of mortar, thickness of mortar joints and workmanship. All piers were built by experienced bricklayers, using a 1:3 portland cement mortar with no lime addition. The piers varied in age from 28 to 92 days.

The brick comprised down-draft, repressed common clay; up-draft repressed common clay; Hudson River soft mud clay, sand-lime brick approved by the Bureau of buildings of New York City; concrete brick made by Peerless brick machines, fed by a continuous concrete mixer and stored for two days in curing tunnel, 1:5 mix; concrete brick, same type made with 1:4 mix; concrete brick of special wet mix with 1:7 mix; concrete brick of special wet mix with 1:5 mix; concrete brick 1 cement, 2½ cinders and 5 parts sand; and finally a series of eleven different experimental mixtures of concrete brick with variable content. The physical properties of the individual brick are shown in Table I.

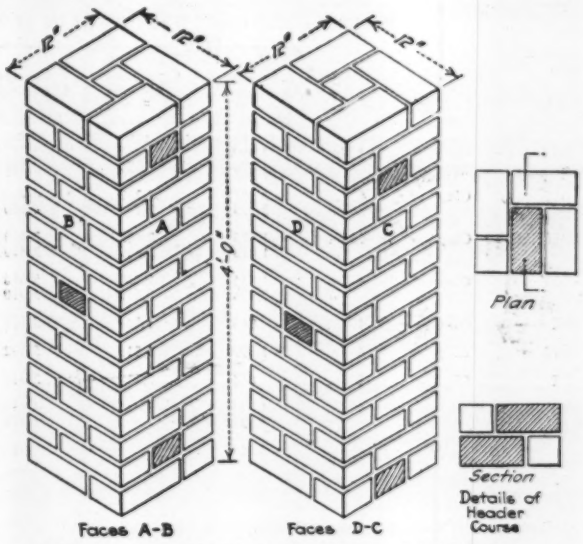


FIG. 1—DETAILS OF 40-IN. PIERS SHOWING BOND

TABLE IA—PHYSICAL PROPERTIES OF CONCRETE BRICK USED IN PIER TESTS.

Series	Composition of Brick Expressed in Parts of Cement, by Volume	At 30-Day Pier Age: Compressive Strength, Lbs./sq.in.	At 30-Day Pier Age: Modulus of Rupture, Lb./sq.in.	At 90-Day Pier Age: Compressive Strength, Lbs./sq.in.	At 90-Day Pier Age: Modulus of Rupture, Lb./sq.in.	Percentage of Absorption in 30 min.	Percentage of Absorption in 4 hr.	Percentage of Absorption in 48 hrs.	Remarks
A-VI	5 of sand passing ¼-in. screen	1,383	300	1,388	366	6.60	9.14	9.86	Cured two days in damp chamber, then stored in air.
A-VII	4 of sand passing ¼-in. screen	2,678	486	2,610	467	10.12	11.50	11.83	
A-VIII	7 of sand	1,923	524	1,892	512	4.12	8.30	9.81	Cured four days in damp chamber, then stored in open air.
A-IX	5 of sand	2,545	630	2,529	547	3.54	8.18	9.61	
A-X	5 of sand, 2½ of cinders	2,462	492	2,508	522	3.10	8.19	11.20	
C-II	6 of sand	1,853	437	.....	...	5.01	10.47	10.81	Cured four days in damp chamber, then stored in open air.
C-III	4 of sand	3,446	638	....	...	3.35	7.61	9.26	
B-III	Miscellaneous	4,704	824	....	...	.....	.....	8.79	.....
B-IV	Mixtures not recorded at request of manufacturer	4,086	751	....	...	.....	.....	9.60	.....
B-V		2,544	538	....	...	.....	.....	10.88	.....
B-VI		3,598	709	....	...	.....	.....	8.65	.....
B-VII		2,329	530	....	...	.....	.....	10.83	.....
B-VIII		1,827	377	....	...	.....	.....	11.78	.....
B-IX		2,737	553	....	...	.....	.....	9.21	.....
B-X		2,056	471	....	...	.....	.....	10.27	.....
B-XI		1,500	325	....	...	.....	.....	12.29	.....
B-XII		3,176	621	....	...	.....	.....	9.02	.....
B-XIII		1,150	274	....	...	.....	.....	12.71	.....

Note: All valves are the average of five to ten individual tests.

TABLE IB—PHYSICAL PROPERTIES OF CLAY AND SAND-LIME BRICK USED IN PIER TESTS

Series	Kind of Brick	At 30 Day Pier Age: Compressive Strength, Lb./Sq.In.	At 30 Day Pier Age: Modulus of Rupture, Lb./Sq.In.	Percentage of Absorption in 30 min.	Percentage of Absorption in 4 hrs.	Percentage of Absorption in 48 hrs.
A-I	Clay	3,245	898	6.71	12.58	13.29
A-II	Clay	4,460	1,578	1.21	3.26	5.29
A-III	Clay	3,450	730	12.80	16.97	17.36
A-IV	Clay	5,010	654	10.68	12.48	13.38
B-I	Clay	3,577	504	.....	.....	18.41
B-II	Clay	5,592	706	.....	.....	16.52
C-I	Clay	2,819	746	15.56	15.98	15.98
A-V	Sand-lime	4,474	750	5.41	11.29	13.79

Note. All values are the average of ten individual tests.

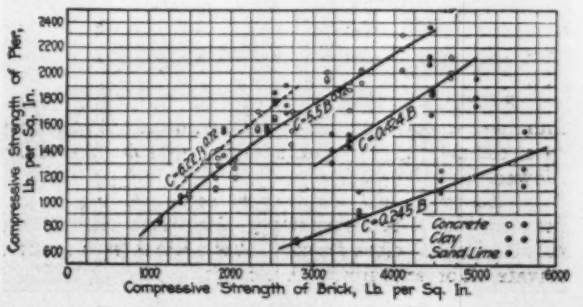


FIG. 2—COMPRESSIVE STRENGTH OF PIER AND OF BRICK FOR 40-IN. HEIGHT AND 30-DAY AGE

TABLE II—COMPRESSIVE STRENGTH OF CLAY AND SAND-LIME BRICK IN 12 x 12-IN. PIERS

			Pier		Bricks			Ratio			
Series	Kind of Brick	Height	Average Compressive Strength, Lb./Sq.In. (1)	Average Compressive Strength of Mortar, Lb./Sq.In. (2)	Average Compressive Strength, Lb./Sq.In. (3)	Average Transverse Strength, Lb./Sq.In. (4)	Absorption in 48 hrs. (5)	(a) (1) ÷ (2) (6)	(b) (1) ÷ (3) (7)	(c) (1) ÷ (4) (8)	Age of Pier
A-I	Clay	40-in.	1,409	1,915	3,245	898	13.3	0.736	0.434	1.57	30
			1,538	2,520	3,245	898	13.3	0.610	0.474	1.71	90
A-II	Clay	40-in.	2,187	2,292	4,460	1,578	5.3	0.954	0.490	1.39	29
			2,473	3,473	4,460	1,578	5.3	0.712	0.554	1.57	90
A-III	Clay	40-in.	1,475	2,487	3,450	730	17.4	0.593	0.428	2.02	29
			1,690	2,449	3,450	730	17.4	0.690	0.490	2.32	91
A-IV	Clay	40-in.	1,841	2,089	5,010	654	13.4	0.881	0.367	2.81	29
			2,136	2,459	5,010	654	13.4	0.869	0.426	3.27	90
B-I	Clay	40-in.	966	1,879	3,577	504	18.4	0.514	0.270	1.92	26
B-II	Clay	40-in.	1,307	1,819	5,592	706	16.5	0.719	0.234	1.85	30
C-I	Clay	40-in.	628	2,119	2,819	746	16.0	0.296	0.223	0.84	31
A-V	Sand-lime	40-in.	1,794	2,441	4,474	750	13.8	0.735	0.401	2.39	29
			2,034	2,412	4,474	750	13.8	0.842	0.454	2.71	92
B-III	Mixture of Clay B-I and B-II	40-in.	1,165	1,368	4,584	605	....	0.852	0.254	1.93	30
A-I	Clay	84-in.	1,255	2,698	3,245	898	13.3	0.465	0.387	1.40	31
			1,421	2,998	3,245	898	13.3	0.474	0.438	1.58	90
A-II	Clay	84-in.	1,750	2,610	4,460	1,578	5.3	0.670	0.392	1.11	28
			1,908	3,160	4,460	1,578	5.3	0.604	0.428	1.21	91
A-III	Clay	84-in.	1,386	2,942	3,450	730	17.4	0.471	0.402	1.90	28
			1,520	2,786	3,450	730	17.4	0.545	0.441	2.08	92
A-IV	Clay	84-in.	1,597	2,007	5,010	654	13.4	0.796	0.319	2.44	29
			1,984	1,643*	5,010	654	13.4	1.207‡	0.396	3.03	90
A-V	Sand-lime	84-in.	1,810	3,137	4,474	746	13.8	0.577	0.405	2.43	28
			2,157	2,298	4,474	746	13.8	0.939	0.482	2.89	92

* Defective Specimens.

The bricks were laid in the bond shown in Fig. 1 with a 1:3 portland-cement mortar joint averaging 0.4 in. thick, with mortar tested from 1,730 to 2,363 lb. per square inch at 28 days. The results of the compression tests are indicated in Tables II and III.

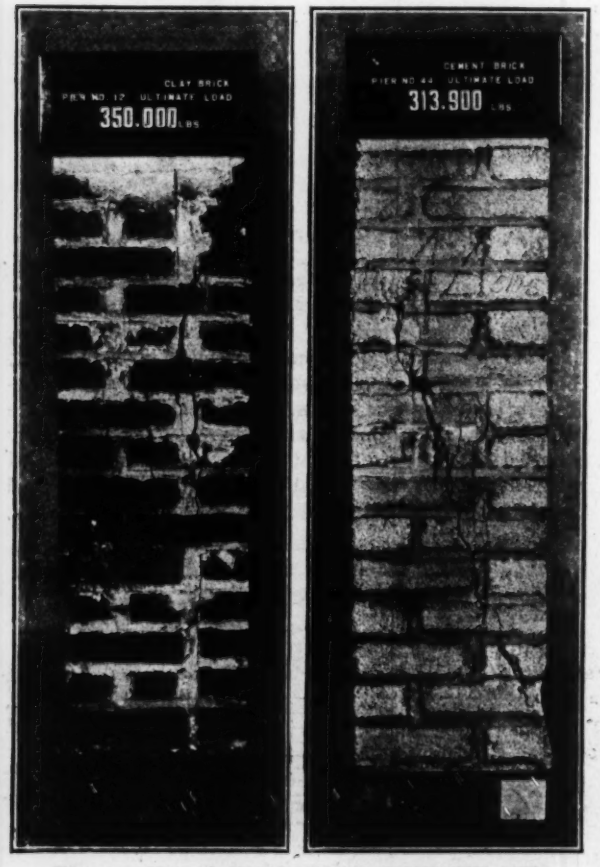


FIG. 3—TYPICAL FAILURES OF CONCRETE AND CLAY-BRICK PIERS

For clay brick no definite relation between modulus of rupture and ultimate compression strength was found. The highest ratio obtained was 0.354 for a down-draft common clay brick, having an ultimate compression strength of 4,460 lb. per square inch and a modulus of rupture of 1,578 lb. per square inch. The average ratio of the modulus of rupture to compression strength in the clay and sand-lime brick was 0.21. For the concrete brick a more or less definite relation was bound to exist between the modulus of rupture and ultimate compressive strength, following the curve $T = 116\ B^{0.75}$, where T is the modulus of rupture or transverse strength of the brick in pounds per square inch and B the ultimate compressive strength in pounds per square inch. The ratio of modulus of rupture to compressive strength decreases as the latter increases.

The relation between the ultimate compressive strength of the piers to the ultimate compressive strength of the brick is shown for 40-in. 30-day piers in Fig. 2.

The behavior of the concrete brick masonry and the clay brick masonry under compressive load at or near ultimate load is shown in Fig. 3. The concrete-brick piers failed in general in diagonal shear as shown in Fig. 4, the resulting fractures resembling very closely the characteristic cone-shaped fractures obtained with monolithic concrete piers.

The paper states: "The characteristic phenomenon of failure in clay-brick piers cannot be fully explained by any theory of diagonal shear. When these are tested to destruction in compressing, the first visible surface sign of incipient failure is a sort of minute vertical crack either in the mortar or near the middle of a brick in line with the mortar joint or both. This crack lengthens and becomes more pronounced as the load increases. Several of these cracks may develop simul-

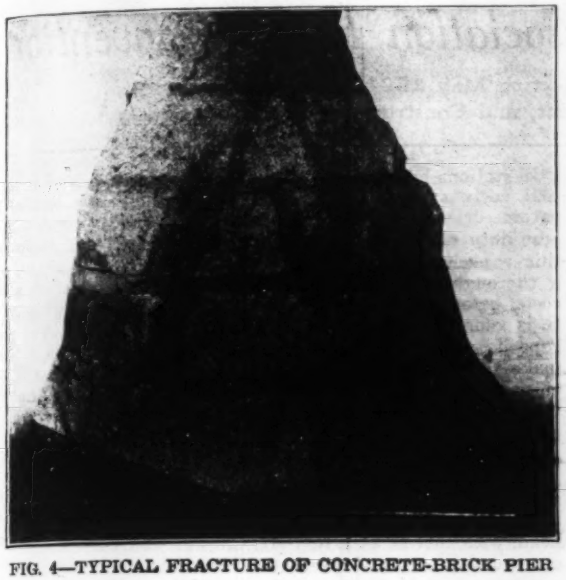


FIG. 4—TYPICAL FRACTURE OF CONCRETE-BRICK PIER

FIG. 5—TYPICAL FRACTURE OF CLAY-BRICK PIER

taneously or else in rapid succession on the four faces of the pier. In most cases failure was confined to the middle two-thirds of the height of the pier. In general the failure in these clay-brick piers occurred not as a monolithic unit but appeared to be a progressive disintegration of the individual brick units and of the mortar and bond between them."

The effect of age upon pier strength was also investigated. The results from clay brick and sand-lime brick were so irregular as to make it difficult to determine an average curve, but it would appear that the difference in pier age from thirty to ninety days resulted in increase in strength of 13 per cent. For concrete brick piers the increase was about 15.8 per cent.

As to effect of height clay-brick piers of 30 and 90 days are reduced in strength as height of pier is doubled, but the loss is less for concrete brick piers.

Investigations into elastic limit indicated that for both clay and sand-lime brick piers the ratio of elastic limit to ultimate strength is 0.47; for concrete-brick piers 0.57 and for some monolithic concrete piers 0.52.

In conclusion the report states that assuming average conditions a concrete brick having an average compressive strength of 1,500 lb. per square inch will, if laid in 1:3 portland cement mortar, form a masonry which will have an average compressive strength of 1,210 lb. per square inch and an elastic limit of 690 lb. per square inch. A clay brick of a compressive strength of 3,000 lb. per square inch will develop an ultimate compressive strength of 1,270 lb. per square inch and an elastic limit of 590 lb. per square inch.

The average modulus of elasticity of clay and sand-lime brick was found to be 1,403,850 and for concrete brick 1,733,200.

TABLE III—COMPRESSIVE STRENGTH OF CONCRETE BRICK IN 12 x 12-IN. PIERS

			Pier		Bricks					Ratio			
Series	Kind of Brick	Height	Average Compressive Strength, Lb./Sq.In. (1)	Average Compressive Strength of Mortar Lb./Sq.In. (2)	Average Compressive Strength, Lb./Sq.In. (3)	Average Transverse Strength, Lb./Sq.In. (4)	Absorption in 48 hr.	Average Age of Pier in Days	Average Age of Brick in Days	(a) (1) ÷ (2)	(b) (1) ÷ (3)	(c) (1) ÷ (4)	Weight of Masonry Lb. Cu.Ft.
A-VI	1 Cement, 5 Sand	40-in.	1,030	2,230	1,383	300	9.9	28	81	0.462	0.745	3.43	
			1,318	2,604	1,388	366	9.9	91	144	0.506	0.950	3.60	121.2
A-VII	1 Cement, 4 Sand	40-in.	1,784	2,682	2,678	486	11.8	28	250	0.665	0.666	3.67	
			1,955	5,280	2,610	467	11.8	90	312	0.596	0.749	4.19	125.1
A-VIII	1 Cement, 7 Sand	40-in.	1,490	1,960	1,923	524	9.8	28	61	0.760	0.775	2.84	
			1,647	2,450	1,892	512	9.8	95	128	0.672	0.871	3.22	125.6
A-IX	1 Cement, 5 Sand	40-in.	1,806	2,222	2,545	630	9.6	28	96	0.813	0.710	2.87	
			2,159	2,542	2,529	547	9.6	93	161	0.849	0.854	3.95	128.9
A-X	1 Cement, 5 Sand, 2½ Cinders	40-in.	1,569	2,586	2,462	492	11.2	29	94	0.607	0.637	3.19	
			2,008	2,331	2,508	522	11.2	92	157	0.861	0.801	3.85	123.8
C-II	1 Cement, 6 Sand	40-in.	1,346	2,099	1,853	437	10.8	33	62	0.641	0.726	3.08	.....
C-III	1 Cement, 4 Sand	40-in.	1,840	2,442	3,446	638	9.3	32	62	0.753	0.534	2.88	.....
A-VI	1 Cement, 4 Sand	84-in.	1,140	2,659	1,383	300	9.86	31	81	0.429	0.824	3.80	.....
			1,358	2,864	1,388	366	9.86	90	144	0.474	0.978	3.71	.....
A-VII	1 Cement, 4 Sand	84-in.	1,832	2,377	2,678	486	11.83	28	250	0.771	0.684	3.77	.....
			2,078	3,206	2,610	467	11.83	92	312	0.648	0.796	4.45	.....
A-VIII	1 Cement, 4 Sand	84-in.	1,394	2,836	1,923	524	9.81	28	61	0.492	0.725	2.66	.....
			1,469	2,277	1,892	512	9.81	90	128	0.645	0.776	2.87	.....
A-IX	1 Cement, 4 Sand	84-in.	1,930	2,139	2,545	630	9.61	29	96	0.902	0.758	3.06	.....
			2,151	2,290	2,529	547	9.61	89	161	0.939	0.851	3.93	.....
A-X	1 Cement, 4 Sand	84-in.	1,759	1,245*	2,462	492	11.20	28	94	1.413*	0.714	3.58	.....
			1,947	2,617	2,508	522	11.20	89	157	0.744	0.776	3.73	.....

* Defective specimens.

American Water Works Association Holds Convention

Abstracts of Papers Read at the Detroit Meeting May 21-24—Pumping Equipment, Financing New Extensions, Water Treatment, and Construction of Memphis Supply

Proper Equipment for Pumping Stations

By Arthur L. Mullergren
Consulting Engineer, Kansas City, Mo.

I PREDICT that in less than ten years the reciprocating type of pump will be almost entirely superseded by the centrifugal pump for practically any condition of service. The steam-turbine-driven centrifugal pump has now reached an overall economy that will exceed the vertical triple-expansion engine flywheel pumping engine under favorable steam conditions. The central electric power stations use this type of prime mover exclusively and have used them long enough to demonstrate their reliability and economy. These stations have now reached an overall thermal efficiency of 18 per cent and it is expected that 20 per cent will be reached shortly. Larger boiler units are being installed with higher steam preservers and higher superheat.

Omaha, Neb., has recently contracted for the installation of a 50-m.g.d. 280-ft. head steam turbine centrifugal pump with a guaranteed duty of 189,000,000 ft.-lb. per 1,000 lb. of steam based on 250 lb. steam pressure at 150° F. superheat and 70 deg. cooling water. This duty is exclusive of the condensate pump and the hurling water pump for the hydraulic air ejector, which two pumps are direct connected on one shaft to a 24-brake-horsepower steam turbine operating non-condensing. The duty included, however, all other auxiliary equipment used by the pump, condenser and turbine. The non-condensing steam turbine for driving the auxiliaries mentioned is used to secure a proper heat balance in the station. Consequently, the total station duty will not be affected and may possibly be improved.

Electric Driven Pumps — Since the development of the central station to its high degree of efficiency and the extensive transmission systems emanating from such stations, there are conditions where electric-motor-driven pumping plants would show a considerably higher duty per dollar of annual charges than a very highly efficient steam plant. This is particularly true in the smaller installations and where electric power is available at reasonable rates. Where synchronous motors can be used, central stations are offering attractive rates to the water pumping plants, as this type of motor assists in correcting the power factor of the transmission system, and the hours for pumping can be, in a great many cases, arranged to suit the central station. Motor-driven centrifugal pumping units have been installed that have shown a combined overall efficiency of 82 per cent, which is a very good showing when we consider that the mechanical efficiency of a vertical triple-expansion flywheel pumping engine is about 93 per cent. Reliability of service is one of the principal reasons that electric drive has not been more generally adopted. However, with the duplicate or loop transmission lines and interconnected central stations, practically as great a reliability as the self-contained plant will be secured. Furthermore, emergency equipment operated independently by an inexpensive steam- or oil-engine installation may be provided, thus insuring absolutely continuous service, and by carrying the fixed charges on this emergency equipment together with the small amount of operating expense that may be incurred in its operation, plus the regular operating expenses and fixed charges of the electric-driven plant, the annual charge of the entire installation may be considerably under the annual charge of a highly efficient steam plant.

Diesel Oil Engine—The Diesel Oil Engine has been developed to a very high state of efficiency and reliability. The investment in this type of equipment is very high but so is the fuel economy, such engines reaching a thermal efficiency of 35 per cent..

In stations having 10 m.g.d. capacity and above, and with coal costs around $6 per ton, the high-pressure steam-turbine-driven centrifugal pump will ordinarily show the best duty per dollar of annual charges. In plants below this capacity, each particular installation would require a thorough investigation and a careful balancing of all costs, before a definite type of plant could be decided upon. It is generally recognized that in plants of 3 to 5 m.g.d. capacity the cross-compound flywheel pumping engine will make the most favorable showing. In regard to thermal efficiency, this may be very true, but it would not hold in every case if the duty per dollar of annual charges was considered.

Discussion—J. N. Chester, Pittsburgh, Pa., the only member who discussed this paper, dissented from Mr. Mullergren's opinion that reciprocating pumps will be replaced by centrifugal units. For a 15-m.g.d. plant, under a 100-ft. head, with coal at $4 a ton, Mr. Chester would use a cross-compound pump, and for higher heads but otherwise like conditions, triple-expansion pumps. If coal should fall in price the steam-driven centrifugal pump would be favored. The falling price of electric current and the rising wage of labor with labor difficulties added, point to the electric-driven pumps—but in every case local conditions must govern in the choice of pumping plant.

In a separate paper F. L. Adams reviewed at length "The Use of Constant and Variable Speed Motors for Driving Water and Sewage Pumps." He dwelt upon the advantages of brush-shifting over slip-ring motors which he said are so great in point of economy that in a short time brush-shifting would pay for itself. But he did not claim that brush-shifting is best for all conditions, although it is for many.

* * *

New Water Supply for Memphis, Tenn.

By James R. McClintock
Of Fuller & McClintock, New York City

A NEW artesian water supply for Memphis, Tenn., with air-lifts both for raising the water from the wells and to give partial removal of carbonic acid, aerators for further decarbonation, mechanical filters for iron removal, low-lift pumps to supply aerators and high-lift pumps delivering direct to the distribution system, a reservoir and other elements is now well under construction with the writer's firm as engineers. The improvements will cost about $2,800,000. The first group of twenty-three wells will have an estimated capacity of about 1 m.g.d. It is expected that the well system can be extended to produce 75 m.g.d. or more which would supply the city for thirty years to come. The fourteen existing artesian wells will be given up, except for a reserve supply, as they sometimes discharge troublesome quantities of sand, and have other drawbacks.

The Wells—The wells are located about 500 ft. apart, having 12-in. casings and 50 ft. of 10-in. Cook strainer. Cast-iron pipe will be used for collecting the water from the wells, while for the air lines to the air-lifts wrought-steel pipe with welded joints will be used, with Dresser couplings every 350 ft. for expansion joints and with flanged joints for all valves and couplings. The reservoir and equalizing basin will be of reinforced concrete and will have a total capacity of about 10,000,000 gal. By walling off one corner a 1,000,000-gal. compartment is secured for equalizing the flow from the wells.

Pumping and Compressing Plant—Four air compressors, each with a capacity of 2,700 ft. of free air per minute against a gage pressure of 100 lb. will supply the air-lifts. To deliver water to the aerators, centrifugal pumps, driven

by water turbines supplied from the high-lift pumps, will be used, each unit having a nominal capacity of 9 m.g.d. There will be two 16.5 m.g.d. steam turbine driven centrifugal pumps and two 15 m.g.d. (but designed to deliver 16.5 m.g.d. when necessary) horizontal cross-compound crank-and-flywheel pumps, delivering water direct to the mains under 200 lb. pressure. The intention is to use the last-named units most of the time.

Aerators and Filters—There will be 40 aerator units distributed in groups of 10 each, consisting of coke-filled troughs, one above the other. (See *Engineering News-Record*, May 17, p. 874 for details of preliminary studies and outline of design.) The iron-removal plant is essentially a group of mechanical filters with a total capacity of 18 m.g.d., a net area per filter of 825 sq. ft., or about 360 sq. ft. per m.g.d. of rated capacity.

* * *

Financing Water Main Extensions in Municipally-Owned Works

By Caleb Mills Saville
Manager and Chief Engineer, Water-Works, Hartford, Conn.

As BETWEEN two common methods of financing water main extensions used where the aim is to avoid the injustice of placing the burden of extensions into new territory on consumers in old territory, the author has concluded that the assessment method is much more equitable than the guarantee-revenue method, for municipally-owned plants. Financing extensions from the tax levy has little or no sound basis, unless it be done in lieu of taxation to meet the cost of fire protection furnished by the city without charge. Even then public utility decisions are against such scrambling of accounts, and generally unite in holding that a water department should receive cash for what it supplies to the city and in return should pay cash for what the city supplies to it.

The word extension is taken to mean the installation of a water pipe of size sufficient to provide proper domestic and fire protection service for the immediate locality, with the water department assuming all cost in excess of the above which is necessitated for the good of the service.

The guarantee method is proper if the payment in rates or otherwise received from the extension is sufficiently large to cover not only the proper portion of all maintenance and operating charges of the water department service but also to pay interest and depreciation on the extension. It is not proper if the guarantee is so small that either water is given away or the burden of the investment is carried by the consumers as a whole.

In some municipal instances the water rates would never meet the conditions named as proper but the administration goes serenely on, and when the income of the department becomes too small to meet expenses rates are raised. In the opinion of the author the best and surest remedy for this condition is governmental regulation of municipally-owned utilities as well as of those under private operation.

With a privately operated utility it seems proper to use the guarantee method, as the profit in the water rates should be sufficient to finance the extension after full development of the locality. With a publicly-operated utility run substantially at cost there appears to be no argument for the use of this method unless it be for an amount in addition to water rates and sufficient to pay interest and amortize principal in a given term of years. This solution logically leads to the assessment method of financing water main extensions.

Some other objections to the guarantee method for use in municipally-operated plants are: (1) Difficulty in getting all abutters in a street to be participants in the guarantee: (2) increased return in property valuation to all abutters on the extension at the expense of those who are uniting to undertake the burden; (3) the fact that through overenthusiasm as to development it may be many years before a return is available sufficient to extinguish the guarantee; and (4) such a combination of conditions that the property may never return an income from water sufficient to meet the guarantee on the cost of the extension, even excluding cost of water supplied.

In the application of the method of special assessment the following conditions should be observed as equitable and reasonable:

1. The water department should determine whether the extension is required by public convenience and necessity and when so decided should establish a definite means for assessment based upon the average cost of laying a water main of proper size to supply both domestic and fire protection service to the street in question.

2. The water department (for the municipality) should pay that proportion of the cost which is for general benefit, usually from one-fourth to two-thirds the cost of the extension.

3. Two methods seem applicable for payment of the assessment: (a) A frontage tax against all abutting property which may be served by the extension; (b) an "entrance fee" for the privilege of connecting with the water main, based on lot frontage.

4. The assessment should be payable in a lump sum or in installments during a fixed term of years.

* * *

Use of Acids with Alum and Importance of pH Concentration

By John R. Baylis
Chemist, Filtration Plant, Baltimore, Md.

A GREAT increase in the amount of alum necessary for coagulation at the Baltimore filter plant in 1922 is attributed to the production of organic emulsoids by an increase in certain micro-organisms attributed to the flooding of an additional area due to increasing the capacity of the Loch Raven storage reservoir on the Gunpowder River. With the hopes of finding a cheaper method of treatment, experiments using acids with alum to change the pH to near the optimum point were conducted. A uniform method of procedure that duplicated plant conditions was adopted for experimental work. In the absence of any standard of clarity for filtered water a turbidity of 0.5 was set as the maximum limit.

The zone of maximum removal of alumina from the water is between pH of 5.6 and 6.6. The optimum pH for best precipitation of the suspended matter was found to be about 5.5. That is, there is a maximum removal of turbidity for a given amount of alum at this value. Under ordinary operating conditions prior to 1922, there was a slight increase in the amount of alum necessary for proper clarification as the pH increased to 7 from 5.5, and a rapid increase as it went higher. The conditions in 1922 caused the rapid increase to start at a pH below 6 instead of 7. This was lower than the pH produced by the addition of alum. The use of acids to reduce the pH to 6 or less effected a great saving in alum. Several acids tried, such as hydrochloric, nitric and sulphuric, were equally effective. Sulphuric, on account of its cheapness, was the only one tried on a large scale. The study of colloidal chemistry is urged as an aid to the solution of coagulation difficulties. The amount of alum necessary for clarification may vary widely with apparently no change in any of the ordinarily found constituents of the water.

It is clearly shown that alkalinity determinations should be made with the use of an indicator that will give a pH of about 5.5 instead of the much lower value given by methyl orange, erythrosin, or lacmoid. Methyl red has been adopted for such use in the laboratory of the Montebello filters. It may be purchased in any form desired and can be used by unskilled workers.

Sulphuric acid was tried on a plant scale and found to be practical and economical (see *Engineering News-Record*, Aug. 31, 1922). Had it been used the entire period in 1922 when it would have been economical there would have been a saving of approximately $12 000 in the cost of coagulants.

[Mr. Baylis's paper appeared in full in the *Journal of the American Water Works Association*, May 1923.—Editor.]

Iodine Treatment of Water Supplies for Prevention of Goitre

By Beekman C. Little
Superintendent of Water Works, Rochester, N. Y.

THE Water Bureau and Health Bureau of Rochester believe that they have evolved a plan for successfully treating and preventing goitre. Simple goitre is generally recognized as a swelling of the neck due to the enlargement of the thyroid gland. In North America, goitre is endemic in the whole of the Great Lakes region and in the basin of the St. Lawrence and the Northwest Pacific region.

Iodine is a natural constituent of the normal thyroid gland. It is essential to normal thyroid activity. The amount of iodine required is exceedingly small, but when this amount is absent, the thyroid gland seeks by increase in size and surface to make up for this lack in iodine, and goitre is the result. In fact, goitre has been described as an adaptation to "iodine deficient" nutrition. It follows therefore that the treatment for goitre now pretty generally practiced is the giving of very small dosages of iodine. An accredited prescription is: one ten-thousandth of a gram of iodine taken daily over a period of from 15 to 20 days given twice a year.

In the recommendation of our plant in Rochester Dr. Goler, the health officer, makes, among other, the following points: "We always have in Rochester among our children, more than 2,000 cases of preventable goitre. We may prevent this goitre by the addition of minute quantities of iodine to the drinking water—two ten-thousandths of a gram to the gallon—in the form of sodium iodide. It will only be necessary to dose the water twice a year, for two weeks. This would require daily 13.3 lb. of iodide of soda for two weeks, or 372 lb. at $4.80 per pound, or $1,785 a year."

The Water Bureau at Rochester has already started this treatment of the water. At one of our reservoirs, from which is drawn all of the water entering the city mains, we have dissolved daily, for a period of two weeks, 16 lb. of iodide of soda, a slightly greater amount than at first suggested. (The iodine was lowered into the incoming water in two 8-lb. bags.) Our consumption of water during this period was approximately 25 m.g.d. In the laboratory of the Health Bureau, and checked up by chemists in the University of Rochester laboratory, it was found that the iodine content in the water increased from one part in a billion parts of water before the experiments, to 20 parts in a billion. Next fall the dose will probably be increased as it is planned to get about 50 parts of iodine to a billion parts of water.

Discussion—Walter Sperry, Grand Rapids, Mich., said that the school children of that city are getting the consent of their parents to take iodine in chocolate at intervals. Mr. Little said that iodine is being given to school children elsewhere in chocolate and also in the water supplied in the school buildings.

* * *

Water-Works Pumping Station Design

By Charles B. Burdick
Of Alvord, Burdick & Howson, Engineers, Chicago, Ill.

FUNDAMENTALLY there is no reason why the water-works station should not present the same attractive appearance as the city hall but an ornate design justified in a city hall or a courthouse would be out of place in a pumping station. Rather it should represent the masculine in architecture without undue pretention; be strong and permanent in its lines and materials; be frankly adapted to its purpose; and present an appearance agreeable to the eye.

Permanence—Water-works construction is now sufficiently standardized so that it is possible to lay out pumping plants subject to enlargement in such manner that the buildings may be useful indefinitely. In the ordinary water-works plant, steam operated, the main entrance, offices, and possibly a laboratory may be grouped and will need little further expansion. The engine room and the boiler room, after providing for the present and the immediate future, may be expanded along parallel lines without necessarily spoiling the architectural symmetry. It is wise to be liberal in selecting dimensions. This tends toward permanency.

Centralization of Business End—If the water is filtered, it is desirable in small pumping stations to centralize the "business end" of all the station operations on account of facility in supervision. This is not always possible when filtration is added to an old water-works. In the layout of a new plant, however, it is practicable to so co-ordinate the expansion of pump room, boiler room, filter plant, coagulation basin, and clear well, that each may be enlarged in an orderly manner with convenience of access between the operating parts and the administrative center of the group. Basins and reservoirs may expand, if necessary, forward from the building, utilizing a space covered over by lawn. Plants in cities up to 100,000 population, or somewhat more, may thus be designed without the necessity for separating the pumping and filtration plants.

Fireproof Construction—The modern water-works station should be the last building to burn in any community. Many water-works stations are practically fireproof except for the roof construction, windows, and the doors. It is practicable to build stations today without using a stick of wood, and at moderate costs as compared to wood. Millwork has increased in price to such extent that there is little difference between wood and metal frames, and concrete and tile construction is generally used for roofs in the most modern stations.

Building Materials—For underground structures or for other structures more or less concealed and protected from the weather, concrete gives excellent service. Where exposed to view or subjected to the action of the elements, it is not proving a satisfactory building material. Wherever possible it is wise to so design reservoirs that they may be filled over and sodded, thus protecting the concrete from the expansion and contraction of hot sun and winter cold, and incidentally better protecting the water from extremes of temperature.

For superstructures, brick and stone are the most satisfactory materials for exteriors, terra cotta may be useful upon the interior or exterior. Upon the interior the surface should be clean and non-absorbent. For floors concrete is satisfactory only in the cheaper structures where it may be successfully used if covered with a heavy non-absorbent paint especially adapted to concrete. In the better stations terrazzo or tile is justified.

Walls, particularly where damp, as in the pumping pits should be faced with a non-absorbent substances such as enamel brick built at least head high. Above this plane pressed brick is satisfactory. At present a rock plaster is available almost as hard as stone which can be worked into very attractive panel designs at moderate cost.

For the roof, exposed steel trusses are generally used with steel purlines and a roof covering of reinforced concrete or tile. To prevent sweating in cold weather a double ceiling is desirable. This may be accomplished by rock plaster on metal lath hung from the purlines. Thin concrete roofs usually become a nuisance at certain times from dripping. A single thickness of 5 in. is usually sufficient to prevent the serious collection of drops. A double ceiling completely eliminates the trouble and costs comparatively little more. Skylights and ventilators must be guarded with gutters for satisfactory results.

Architectural Co-operation—It would be well if all engineers would utilize the services of an architect in the planning of conspicuous engineering works. A good architect possesses a knowledge of orderly arrangement and of the selection and grouping of materials not possessed by most engineers. On many classes of structure the architect should be and is the master builder and the engineer is properly a subordinate. Upon such special structures as water-works buildings the engineer must be the master builder, but he is wise if he fully utilizes the services of one skilled in architectural design. This must be done by co-operation, the engineering plans and the architectural plans should be worked out together step by step, as a unit.

The water-works manager should not ignore public approval relating to his work and his plant. Self-respect engenders respect from others. Capable operators say that

employees take better care of their machinery and are more contented when working in attractive surroundings. A good plant is an important element of good service. The time has come when water-works designers can safely plan for the future and build for permanence.

* * *

Estimating Bills When Meters Fail to Register

By W. C. Hawley
Chief Engineer and General Superintendent, Pennsylvania Water Co., Wilkinsburg, Pa.

THERE are few more perplexing duties which the water-works manager is called upon to perform than estimating what is the proper and just amount of water to be charged for when the meter has stopped registering. Fortunately a very small percentage of the meters in service fail to register and again, fortunately, in the majority of such cases there is little difficulty in making a bill to which there can be no reasonable objection on the part of the consumer, but there are, occasionally, cases for which it is extremely difficult to find a satisfactory solution.

It is important that the fact that a meter is not registering should be discovered at the earliest opportunity. The meter reader should therefore be given instructions to pay particular attention to this matter. In case the registration for the period is less than ordinary he should open a spigot and watch the 1-ft. hand to see if the meter is registering. The meter books, when returned to the office after reading, should be carefully inspected and all suspicious readings should be listed, and inspectors sent to make check readings. This will be found worth while not only in picking up meters which are not registering and have been overlooked by the meter reader, but in the elimination of mistakes in meter reading, and thus saving trouble over incorrect bills.

In cases where the rate of registration has not been uniform it may be advisable to use as a basis the rate of registration for the period immediately preceding the billing period or to use, at least as a check, the rate for a period of three or four weeks after a new meter, or the old meter repaired, has been set. If there is a material difference between the rates of registration immediately before and after the period to be billed it may be best to use the average of the two rates as the basis for billing if the two periods were of about equal length. If they were not, probably the best solution will be made by the use of squared paper, using the horizontal scale for time and the vertical scale to represent either the meter readings or registration. By prolonging the lines into the period for which the registration is to be estimated until they intersect, we can find the probable date when the change in rate of registration took place, and thus determine approximately the periods during which each rate of registration occurred and the total amount.

* * *

Miscellaneous Matters

Question Box—Flushometer water closets aroused much interest. Dow R. Gwinn said that the Terre Haute Water Co. does not allow flushometers. In one case an exception was made but the company held fast to its rule for a ¾-in. service pipe from the main to the curb (laid at its expense). The plumber had already put in a 1¼-in. service pipe from the curb to the house for the property owner. It was agreed to let this be used but on it the house owner installed a 40-gal. tank so pipe-connected that its upper portion serves as an air cushion when the closet is flushed. It has given satisfaction. W. C. Hawley, Wilkinsburg, Pa., reported the use of a similar device. J. N. Chester, Pittsburgh, argued for services and meters as large as any customer desires but with a service charge based on the size chosen. W. S. Cramer, Lexington, Ky., has found that a service charge of $1.50 per quarter will not deter the use of flushometers but a $3 charge will. A speaker interested in the sale of flushometer valves stated that thirty per cent of all decent water closets put in have been of the flushometer type. This type may need a larger service but it conserves water, he said.

Briefer Mention—Meteorological observations by water departments up to the full range of the general run of Weather Bureau stations, were urged by Scotland B. Highland, Clarksburg, W. Va., where such observations are conducted by the Water Board, including the maintenance of automatic recording gages on each main tributary in the water shed. Frank C. Jordan, Indianapolis, urged co-operation between water companies or departments and city departments in general. He cited such co-operation between the Indianapolis Water Co. and the fire, health and school departments of that city, the joint activities including means to finance domestic plumbing installations in small houses. The use of a portable air compressor mounted on a Ford truck, for breaking concrete pavement and other purposes was described by F. C. Amsbary, Champaign, Ill. The outfit, including pavement-breaking tools, cost $1,723. Its feasibility for so small a place is due to leasing it to local contractors.

In a paper on "Unaccounted For Water," J. N. Chester, Pittsburgh, reviewed data showing figures from an average of 27 per cent reported in 1916 (*Journal* N. E. W. W. Association) to approximately 38 per cent at Norfolk, Va., and Knoxville, Tenn. In the Pittsburgh rate case 33 per cent was allowed. Mr. Chester has found the combination of the pitometer and the geophone useful in locating leaks.

Laying water mains and service connections in the same trench but above the sewers when the latter are in rock is practiced in New York City for economy, said W. W. Bush, but the water pipe is not laid until some months after the sewers. From Cleveland Mr. Ruggles reported that water and sewer pipes are laid in trenches 5 ft. apart, except that in rock services are laid on a shelf above the sewer.

Whether the service pipes from main to curb should be laid when the main is put down or at least before the street is paved brought out a variety of opinion, but of those who spoke there seemed to be a majority against compelling service installations in the streets before actual connections to houses are to be made. This was based on the uncertainty of both the time and the exact location of the house connection and the large idle and sometimes wasted investment that may result when services are made before houses are built or connected.

Algae growths was a question-box topic that brought many to their feet. W. S. Cramer, Lexington, Ky., said that in treating water with copper sulphate bays and ponded areas should not be overlooked. At the inlet of a small stream to a reservoir he applies copper sulphate by means of a bag of close weave attached to a paddle wheel driven by the stream.

Boundary Commissioner Arthur A. Stiles

Through an error in the United States Supreme Court order, the name of Arthur A. Stiles was given as Arthur L. Stiles in the assignment as commissioner of the Supreme Court to determine the boundary between Texas and Oklahoma. The error was repeated in the article describing the boundary survey work in *Engineering News-Record*, Apr. 19, 1923. It is here corrected as a matter of record.

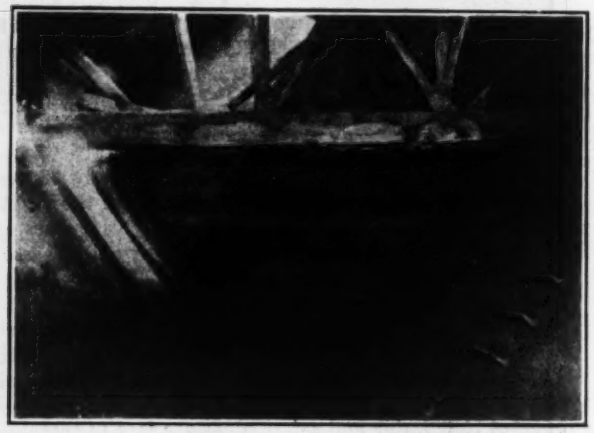
From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Lining Coal Bunkers with Concrete

By C. M. Daily
Engineer-in-Charge Supply and Purifying Section, Division of Water-Works, St. Louis, Mo.

STEEL coal bunkers having elliptical bottoms were erected in the Baden boiler room of the St. Louis water-works in 1920 and heavily coated with asphaltic paint. The bunkers were built so close to the roof that the roof girders passed through them. After two years' service the roof girders, steel sides and bottoms of the bunkers were beginning to corrode. It was decided in March, 1922, to cover the inside of the bunkers and the roof girders with gunite. The surface was cleaned with a sand blast and holes were drilled and tapped in the sides and bottoms of the bunkers 4 ft. c. to c. Stud bolts were screwed in the holes with the heads extending about ¾ in. from the plates. Over the entire bunker surface to be protected a triangular mesh reinforcing wire weighing 28 lb. per 100 sq.ft. was laid and wired to the stud bolts, after which 1½ in. of gunite was applied in three coats. The roof girders were wrapped with the reinforcing wire and covered with gunite applied the same as on the bunker. Cement gun No. 0 was used for the purpose.



GUNITED COAL BUNKER, ST. LOUIS WATER-WORKS

It was found necessary to cover the bunkers with tarpaulins to prevent sand grains from rebounding and injuring the machinery in the boiler room; this made the work exceedingly difficult and uncomfortable for the nozzle man

The cost of covering 10,650 sq.ft. of surface was:

	Cents per Sq. Ft.
Labor, sand-blast	4.0
Labor, drilling	3.9
Labor, wiring	3.24
Shooting gunite	12.1
Miscellaneous and overhead	5.9
Wire	2.28
Bolts	.18
Cement	4.56
Sand	1.18
Total	37.34

The costs of labor items are high, due principally to the care exercised in preventing sand grains from rebounding, and also to the presence of roof girders which pass through the bunkers. When work was first started, experienced machine men were employed, but after a short time it was found much cheaper to break in new men who were willing to learn than to use the old men who were not accustomed to this particular type of work.

While the cost of 37.34c. per square foot seems high it is much cheaper than placing forms inside of the curved surface and pouring the concrete, as was done in similar bunkers a few years before at one of the other pumping stations.

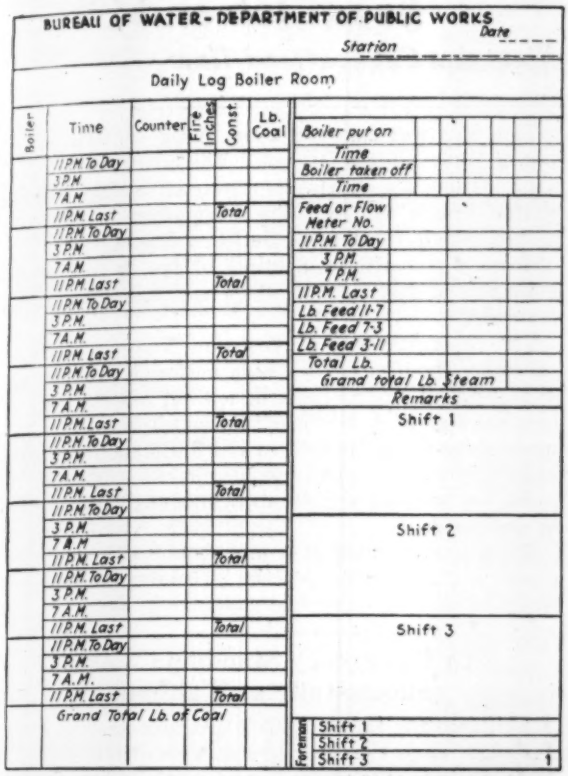
Simplified Pumping Station Records

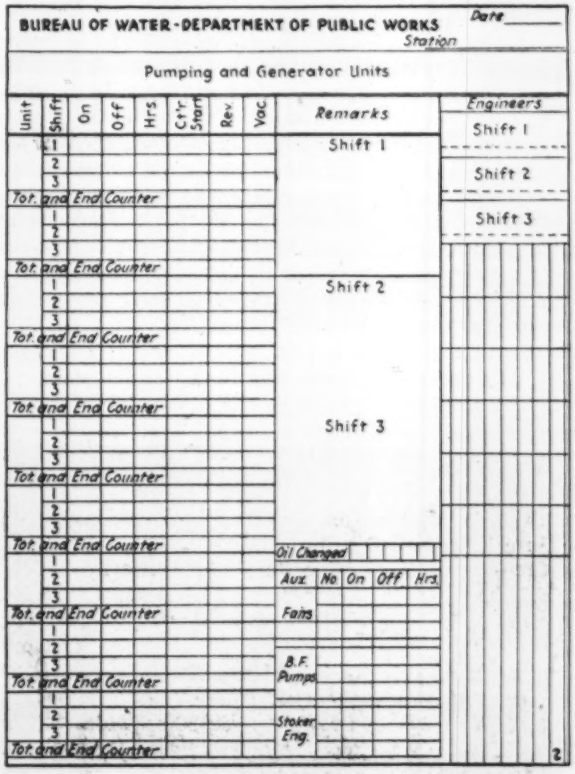
By H. R. Cady
Mechanical Engineer, Bureau of Water, Philadelphia

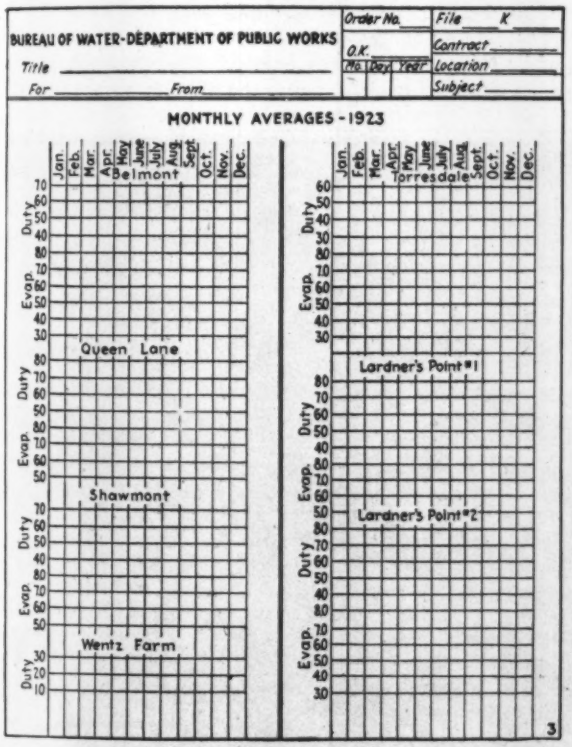
IN A modern pumping station, particularly one having steam-driven pumps, there are so many different and varying pressures, temperatures and possible measurements of weight or volume that if care is not exercised to select readings having particular significance, and susceptible to modification by varying operating methods, a mass of figures having no real value may be collected. Too numerous readings, not definitely correlated with operating efficiency, are only a little better than no records and are costly to obtain.

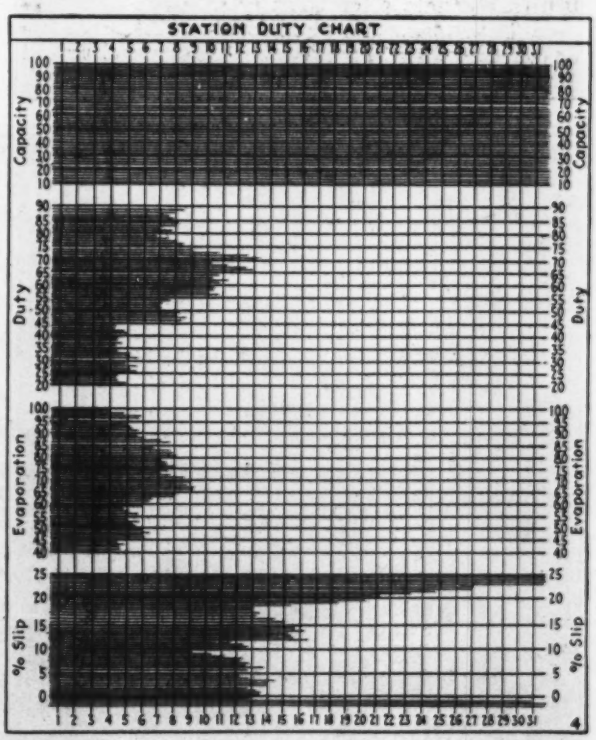
In the Philadelphia Bureau of Water, where formerly a rather complicated pumping station log was in use, the simple 8½ x 11-in. sheets reproduced herewith provide all desired information on work done, units in service and fuel consumed. The sheet for pump and generator units covers combined pumping and generator stations and stations having either motor-driven pumps or steam-driven units of plunger or turbo-centrifugal type.

To bring station operations down to a basis which may be easily and quickly grasped, daily station work is expressed in terms of duty in foot-pounds per 100 lb. of coal. To localize somewhat the lack of efficiency, evaporation of water per pound of coal is figured and also slip of pumps. Slip as applied to centrifugal pumps is a misnomer but the figure called slip in that case is really an expression of capacity deficiency based on what the pump will do if kept in good condition and operated properly. The three values mentioned together with quantity of water pumped, are posted daily in the offices of the chief engineer and the superintendent of pumping stations. Posting on graphic charts is done by means of short glass headed pins of different colors. At the end of each month the average values of evaporation and duty are plotted on a similar graphic sheet and these prints are sent to all engineers in order to permit comparison of results. Since this chart is progressive the last one of the year is kept for a per-









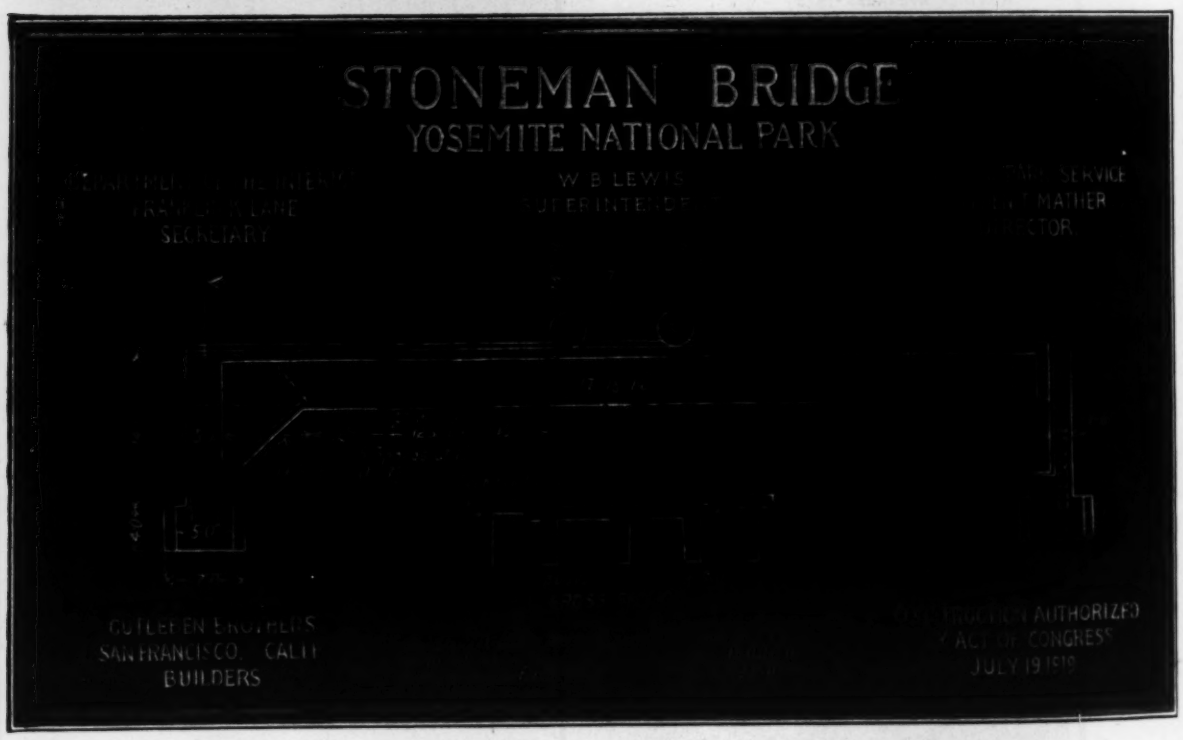
PUMPING STATION RECORD FORMS AND CHART BUREAU OF WATER, PHILADELPHIA, PA.
The original three tabular record sheets are 8½x11 in., and of the graphic chart about 14x18 in.

manent record, but daily charts are not preserved unless required for the study of some particular question.

As a basis of comparison, a duty based on results of various parts of station equipment has been calculated.

Bronze Tablets on Bridge Preserve Data on Structural Details

ELABORATION of an idea first adopted by the National Park Service in 1918 in Yosemite National Park has led to embedding in bridges over the Merced River bronze plates showing the stress diagrams and giving load information upon which the bridge design was based. Use of bronze plates was first made in 1918 when one was placed upon the new power house building. The original plates were set merely for informative purposes and carried the names of the Secretary of the Interior, director of the National Park service and superintendent of the park at that time, as well as the names of the designers and builders and references to acts of Congress appropriating funds for the plate.



BRONZE BRIDGE PLATES GIVE DESIGN DETAILS
In the upper view is shown the plate on the Sentinel Bridge and in the lower view that on the Stoneman Bridge.

From Job and Office

Hints that Cut Cost and Time

This idea was enlarged upon in the construction of two or three bridges later on. The accompanying photographs indicate clearly the character of data included on the bronze tablets. The suggestion to place the bronze tablets came from Gutleben Brothers, the contractors who built the Sentinel bridge as well as the Stoneman bridge, both of which are structures several years old.

The superintendent of Yosemite National Park asserts that the idea has not been uniformly followed out in subsequent bridge construction but asserts that the idea has a great deal of merit inasmuch as in the marking of large bridge structures which will stand for many years stress and structural details are imperishably preserved whereas original drawings might become lost or destroyed.

The plates are made of bronze about 8 x 10 in. and are placed in such position on the structure that they can easily be seen by those who cross the bridge.

An Emergency Standpipe Works Successfully at Waltham

DURING the fall of 1922 it was necessary to empty and repair the concrete standpipe of the Waltham, Mass., water-works system, and George Brehm, director of public works was confronted with the necessity of providing an equivalent head of water on the city mains while the standpipe was empty. The elevation of the only other source of supply, the old city reservoir, was

From Job and Office

For Contractor and Engineer

205 ft. while the recent development of outlying sections of the city required a head of not less than 235 ft. To provide this head an 8-in. wrought iron pipe was tapped into the 24-in. feed pipe that normally supplied the standpipe and was run up onto the embankment of the old city reservoir. Here the pipe was run up into the air to an elevation of 276 ft. and then turned out over the reservoir so that the discharge would fall clear of the embankment. The pipe was securely guyed against wind pressure. The pumps were then started and kept running twenty-four hours a day, the speed being regulated to maintain enough pressure to keep a slight overflow from the 8-in. pipe. This method of maintaining the pressure in the mains was continued for a month with complete success.

Street Signs of Bracket Type Installed at Portland, Ore.

THE CITY of Portland, Oregon, has installed 110 new street signs covering about forty city blocks in the west side business district. Two signs are placed at each intersection on diagonally opposite corners. The sign consists of a 3-in. galvanized-iron standard surmounted by two arms at right angles, each made up of two plates of No. 14 gage ingot iron placed back to back and spot-welded on the ends. Street names are readable from four directions. White letters are raised upon a background of blue. The sign plates are placed at a height of 8 ft. above the sidewalk.

BRACKET STREET SIGN 8 FT. ABOVE PAVEMENT

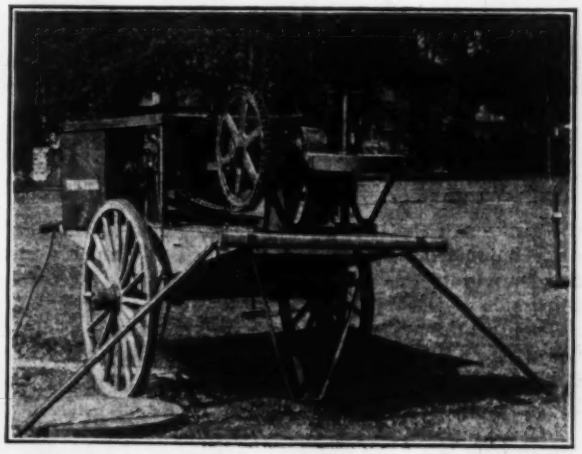
Where city light posts are suitably located the signs are bracketed to the post at the proper height. Where the standards are used they are held rigidly in place by being embedded in 2 ft. of concrete. The bottom of the standard is split by a 6-in. slot and edges are flared out in order to secure a firm anchorage in the concrete base. They are set about 2 ft. back from the face of the curb.

The contract for standards and sign plates was awarded to the Coast Culvert & Flume Co. of Portland. The price bid by this company on the plates, of which there are 440, was $338.80 f.o.b. Denver, Colo. The price on the 3-in. posts, 110 in number, was $6.30 each, which included the four-way mounting for the sign plates attached to the tops of the posts. The special brackets used on light posts were made in the municipal shop at a cost of about $5 each.

It is expected that the use of these signs will be extended to other parts of the city, especially throughout its central part.

Electrically-Operated Valve Opener for Pumping Station Gates

FOR operating the one hundred valves in the pipe lines leading from the pumping station of the Detroit water-works a two-wheeled hand push-cart valve opener has been in successful operation for more than a year. The valves are equally divided between the 42- and 48-in. sizes and formerly were opened or closed by hand. A 48-in. valve requires 40 minutes' time of two men to make the 225 turns, but with the present motor-driven opener these large valves can be closed in 7 minutes, a decided advantage when a serious break has occurred. Bypass valves are always closed by hand.



DETROIT PUMPING STATION VALVE OPENER

Triple reduction from motor to valve stem effected by belt, chain and bevel gear permits closing a 48-in. gate in 7 minutes.

The machine consists of a 5-hp. motor driving a 4-in. belt connected to a pulley on a jackshaft which is supported by pulley hangers. The jackshaft carries a sprocket driving through a chain the large sprocket wheel shown in the center of the picture (reproduced herewith), which in turn drives the bevel gear reduction unit carrying the gate key. The latter slides up and down on a feather key through the horizontal gear so that it may easily be dropped over a gate stem, after which the two supporting legs at front and rear are blocked up to level the platform.

All stems are made with 2-in. square heads for socket wrenches. The anchor rods prevent side motion although they are not often needed, according to Harry W. Gould, superintendent of the pumping station.

Current is furnished to the three plugs located at convenient points around the pumping station yard. The locations of these plug-in points and all the valves are noted on a map in the station on which are "open" and "shut" markers, changed as the valves are operated. As the first of the three reductions is by a belt which can slip the valves start without jerking. A counter on the large bevel gear enables the operator to shut off the current 2 or 3 turns before the final open or closed position is reached although no harm would ensue, the belt simply slipping. The final seating turns are made by hand.

The valve opener was devised by H. B. Kenney, formerly assistant superintendent, and built in the shops of the water department.

Slide Rule Solution of Cosine Formula

BY D. L. BISSELL
City Engineer's Office, San Diego, Calif.

WHAT I consider a much simpler method of solving the cosine formula by slide rule than that given in *Engineering News-Record*, April 26, p. 759, is contained in the following paragraphs. Referring to the accompanying figure:

Set the index of the sine scale to 415, then on the A scale opposite 30 deg. 20 min. read 210, representing

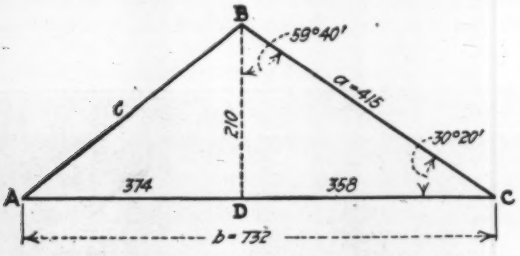


FIGURE FOR SOLVING COSINE FORMULA

the altitude of the triangle. On the *A* scale opposite 59 deg. 40 min. (the complement of 30 deg. 20 min. and the third angle of the right triangle *BDC*) read 358, the third side of the triangle *BDC*.

Then, on the tangent scale set the index to 374 (732 – 358). Over 210 on the *D* scale read the angle *CAB*, 29 deg. 20 min. Set sine of 29 deg. 20 min. to 210 and on the *A* scale read 428 +, the required side.

Diagram for Designing Tunnel Roof Slabs

BY RICHARD P. WALLIS
The Lundoff-Bicknell Co., Cleveland, Ohio

THE accompanying diagram was recently prepared by the writer to aid in the study of the economics involved in the location of a reinforced-concrete service tunnel contemplated for a certain large industrial plant. In this particular plant it was proposed to convey the various utility services, such as heating mains and returns, water supply, electrical lines and low-voltage circuits, by tunnel from the central power plant to the various units in the group. A cross-section 6 ft. wide and 6 ft. 6 in. high was established as a standard for this tunnel. The lines of pipe were supported on iron racks so no direct load from this source is carried by the roof.

As the topographical features of the area occupied by this group contain many eminences and depressions it was evident from the first that it would prove uneconomical to establish a uniform construction for the tunnel in all locations. The nature of the soil is such that the pressure on the side walls varies but little for different depths and accordingly the principal pressure to guard against is that caused by the hydrostatic pressure of the ground water. The tunnel was therefore designed with a constant cross-section with the exception of the roof slab which varies for different depths and was well waterproofed with integral waterproofing at the same time provision being made for carrying away whatever groundwater there might be present by parallel lines of drain tile laid at each side of the tunnel.

From Job and Office

Hints that Cut Cost and Time

For ease in comparing the necessary roof construction for different depths of tunnel the four important factors, total thickness of slab, area of steel required per lineal foot of tunnel, number of ⅝-in. round rods and the spacing of these rods were reduced to functions of *D*, or the distance from the surface of the ground to the top of the tunnel roof slab, and platted as curves on the accompanying diagram.

The various assumptions upon which these curves are based are as follows: The concrete is proportioned as a 1:2:4 mix capable of developing a stress of 2,000 lb. at 28 days with unit stresses of 16,000 and 650 lb., respectively, for steel and concrete. The weight of the soil was found to average 100 lb. per cu.ft. and the concrete 150 lb. A live-load of 35 lb. per sq.ft. was assumed

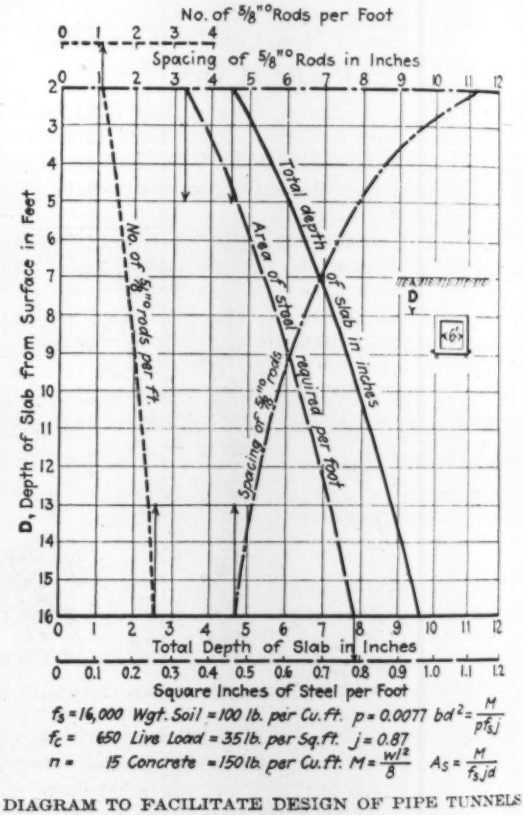

No. of ⅝"ø Rods per Foot
Spacing of ⅝"ø Rods in Inches
D, Depth of Slab from Surface in Feet
No. of ⅝"ø rods per ft.
Area of Steel required per foot
Spacing of ⅝"ø rods
Total depth of slab in inches
Total Depth of Slab in Inches
Square Inches of Steel per Foot
f_s=16,000 Wgt. Soil=100 lb. per Cu.ft. p=0.0077 bd²=M/pf_sj
f_c=650 Live Load=35 lb. per Sq.ft. j=0.87
n=15 Concrete=150 lb. per Cu.ft. M=wl²/8 A_s=M/f_sjd

DIAGRAM TO FACILITATE DESIGN OF PIPE TUNNELS

as superimposed on the surface of the ground. This is about the maximum load likely to be caused by a gathering of people. As will be noted from the above this diagram applies only to those locations where the probable live-load will not exceed that limit. Under roads or in other locations where subjected to concentrated loads special construction must be resorted to to meet the individual requirements of location.

The limits of depth selected for the diagram are from 2 to 16 ft., the former being the minimum amount of earth necessary to support vegetation and the latter representing about the maximum depth set by the re-

From Job and Office

For Contractor and Engineer

quirements of the service lines contained within the tunnel.

The use of ⅝-in. round rods as reinforcing for the roof slab was assumed in the preparation of this diagram. Any other size rods might have been adopted in this connection but the size selected represents a conservative mean as regards availability and ease in handling.

No attempt was made to vary the design of the roof slab for local variations of depth as this practice, while possibly economical as regards the quantity of concrete and steel necessary, only leads to endless confusion and increased cost in the actual construction of the work in the field. Different units of tunnel were, however, arbitrarily considered as having the same roof section area, the section selected in each case being that capable of sustaining the maximum load. The determination of the length of such units is influenced by the relation of the grades established by the pipes and the surface of the ground.

It becomes possible by the use of this diagram to estimate with considerable speed and accuracy the quantity of concrete and steel required for various tunnel layouts. To increase the facility with which reference may be made to the various curves the base line for each curve is shown in the same convention as the curve itself.

The use of this diagram is simple. Suppose for example that the maximum depth assumed for a section of tunnel is 10 ft. It is only necessary to enter the diagram on the horizontal line corresponding to 10 ft. on the vertical scale, continuing until intersecting curve marked "Total depth of slab in inches." Referring this intersection to the horizontal scale corresponding to this curve the value is read off as 7.9 or 8 in. This value of 8 in. includes 1 in. of fireproofing below the steel. The corresponding values obtained for "Area of steel," "Number of ⅝-in. round rods," and "Spacing of ⅝-in. round rods" are 0.636 sq.in., 2.1 rods and 5.8 or 5¾ in., respectively.

Determining Height of Tower Panels When Diagonals Are Parallel

BY A. L. FROST
Boston, Mass.

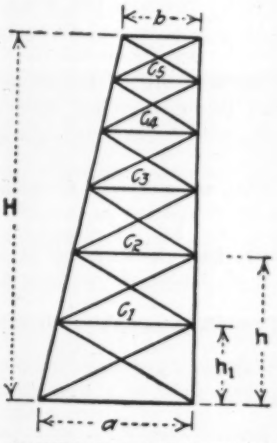
WHEN FOR the sake of appearance, or for other reasons, it is required that the diagonals of a tower or bent be parallel, the problem is that of dividing a trapezoid (or an isoceles trapezium) into n panels in such a way that the diagonals shall be parallel. For instance, let it be required to divide the bent shown in the accompanying figure into six panels.

To effect this we use the following formulas, where n is the number of panels:

$$c_1^n = a^{n-1}.b$$
$$c_2^{n-1} = c_1^{n-2}.b$$
$$c_3^{n-2} = c_2^{n-3}.b$$
$$c_4^{n-3} = c_3^{n-4}.b, \text{ and so on}$$

The height h corresponding to any horizontal c can be determined from

$$n = H \left(\frac{a - c}{a - b} \right)$$



TOWER WITH DIAGONALS PARALLEL

For most practical purposes it will be sufficiently accurate, after computing the first horiztonal from

$$c_1^n = a^{n-1}.b$$
$$\text{or } c_1 = \sqrt[n]{a^{n-1}.b} \quad (1)$$

to determine h_1 from

$$h_1 = H \left(\frac{a - c_1}{a - b} \right) \quad (2)$$

After drawing c_1 and the first diagonal, which determine the first panel, the remaining panels can be found with sufficient accuracy graphically.

Thus, if $a = 6$ ft., $b = 4$ ft.; $H = 18$ ft., $n = 6$, we have by substituting in (1)

$$c_1 = \sqrt[6]{6^5 \times 4} = 5.608$$

Substituting this value for c_1 in (2)

$$h_1 = \frac{18(6 - 5.608)}{6 - 4} = 18 \frac{0.392}{2} = 3.528, \text{ i.e.;}$$

$$h = 3 \text{ ft. } 6\tfrac{3}{8} \text{ in.}$$

Hold Plate-Girder Abutments by Brackets

IN ORDER to hold the yielding abutments of a deck plate-girder railway bridge of 34-ft. span near Vienna, Austria, downward-projecting steel brackets have been attached to the bottom flange of the girders close to each abutment, and the abutments blocked against these brackets to hold them from movement. The case is reported by L. Herzka in *Der Bauingenieur* of Nov. 15. The abutments showed movement soon after the bridge was built, which was a number of years ago, and ultimately the span at the bridge seats was shortened 16 in. A system of timber struts was wedged between the abutments to hold them. This strutting was effective, but when the timberwork was weakened by decay a more permanent bracing system was decided upon. The four main girders were, therefore, fitted close to each abutment with brackets riveted to the bottom flange and projecting 6 ft. down. The face of the bracket is about 12 in. away from the face of the abutment. Timber wales bearing against a lagging of planks to distribute the pressure to the masonry are wedged tightly against the brackets. The strength of the brackets is proportioned for a thrust of 13 tons each, an amount computed from the theoretical active earth pressure against the abutments. This bracing system was installed early in 1922 and according to measurements made in the following fall proved entirely effective in preventing movement of the abutments. An analysis of the action of the brackets under load on the bridge showed that not only are the bending moments in the girders greatly reduced, but the effect of the live-load on the stability of the abutments is eliminated by the increased outward thrust of the brackets.

Disapprove of Direct-Oxidation Process for Sewage of Trenton, N. J.

THE resolution disapproving the plans for treating the sewage of Trenton, N. J., by the direct-oxidation process and advising a less costly method, but giving the city a month for further consideration and a chance to resubmit the plans as for an experimental plant, adopted by the New Jersey State Board of Health on May 1, 1923, ar given in full below, together with a table of comparative costs prepared by the Engineering Bureau of the Department:

WHEREAS, On March 23, 1922, the Board of Commissioners of the City of Trenton by stipulation in the Court of Chancery agreed to adopt a plan for the disposal of sewage and other polluting matter from the City that shall be approved by the Department of Health of the State of New Jersey; and,

WHEREAS, The City of Trenton to comply with this stipulation submitted to the Department of Health in December, 1922, for its approval, plans for the construction of a sewage treatment plant which involves a method of sewage treatment known as the direct oxidation method of sewage treatment, which includes the installation of mechanical fine screens, apparatus for the application of pulverized lime to the screened sewage, cells for the application of electricity to the lime sewage, and a tank or thickener for the sedimentation of the effluent from the cells; the final effluent to be discharged into the Delaware River through submerged outlets; and,

WHEREAS, This Department is of the opinion that the Direct Oxidation method of sewage treatment is still in an experimental stage and has not been demonstrated as a practical and continuous method for the treatment of sewage; and,

WHEREAS, This Department is of the opinion that the expense of the system as proposed for the City of Trenton is considerably in excess of the requirements of the existing situation, and believes that the City of Trenton could employ a less costly method both as to first cost and cost of maintenance as indicated in a table prepared by the Engineering Bureau of the Department, appended hereto; and

WHEREAS, this Board further believes that a plant for the treatment of sewage by sedimentation only, if properly constructed and operated, should suffice to handle the sewage of Trenton without further treatment for at least ten years and probably for considerably longer, or in lieu thereof that a satisfactory treatment of the sewage of Trenton could be had by the use of mechanical fine screens, apparatus for the application of pulverized lime to the screened sewage, and a tank or thickener for the sedimentation of the lime sewage, the effluent then to be discharged into the Delaware River from the system; therefore,

BE IT RESOLVED, That the plans be returned to the City of Trenton with the statement that this Board refuses to approve this method of sewage disposal for the City of Trenton, but that the City of Trenton be given one month in which to give this matter further consideration and if they desire to do so, to re-submit the plans. which will then be considered by this Department as an experimental plant.

COMPARISON OF COSTS OF DIRECT OXIDATION AND SEDIMENTATION METHODS

Municipality	Average Dry-Weather Sewage Flow Gal. per Day	Method of Treatment	Information as to Cost	Cost of Construction	Annual Charges for Capital, Labor, Etc. Uniform Capital at 7½ Per Cent*	Labor, Power, Maintenance, Supplies	Total	Cost per Million Gallons Capital	Operating	Total
Trenton	18,000,000	Direct oxidation	G. A. Johnson's report to City of Trenton, 1922	$1,063,000	$79,725	$125,910	$205,635	$12.13	$19.16	$31.29
Trenton	18,000,000	Sedimentation (Imhoff tank)	Supt. of Albany sewage-works. Construction cost as of 1914; operating cost as of 1921.	582,788	43,709	60,641	104,350	6.65	9.23	15.88
Phillipsburg As of March, 1922	970,000	Direct oxidation	Dept. report	164,535	12,340	.....	.....	34.85	35.06	69.91
Phillipsburg As of March, 1923	700,000	Direct oxidation	Contract to operate for $12,000 a yr.†	164,535	12,340	12,000	24,340	48.30	46.96	95.26
Phillipsburg	2,000,000	Direct oxidation	Dept. report	164,535	12,340	17,447	29,787	16.90	23.90	40.80
Phillipsburg	2,000,000	Sedimentation (Imhoff tank)	Supt. of Plainfield sewage-works. Construction cost as of 1916; operating cost as of 1922.	43,408	3,255	6,000	9,255	4.46	8.21	12.67

* For the sake of uniformity and simplicity, Col. George A. Johnson's 7½% capital charge is used all through this column, although the compilers of the table felt that a lower rate should be used for tanks, etc., than for the machinery in the Trenton estimates.

† The sewage-works at Phillipsburg, N. J., are now being operated by the Direct Oxidation Disposal Corporation for a payment to the company of $1,000 per month, the contract covering a period ending Dec. 31 of this year—EDITOR.

Co-ordination of Land Development Needed

IN AN address delivered recently before a land settlement conference at Berkeley, Calif., Frank Adams, director of irrigation investigations for the University of California, discussed in detail the various factors which must be taken into consideration in planning the development of new irrigation projects. One phase of his address gave attention particularly to the need for better co-ordination of development agencies. In this connection he said:

Certain areas in California are now suffering from what has probably been an inevitable and perhaps a necessary lack of co-ordination of development agencies overlapping the same areas such as reclamation districts, irrigation districts, drainage districts, and levee districts.

Irrigation districts are created on vote of the electors, normally with the approval of the state engineer and their financing is controlled by the Bond Certification Commission. Reclamation districts are formed on petition of holders of title representing one-half or more of the land to be included and reclamation taxes are levied according to benefits by the county supervisors after assessment by distinterested commissioners. Drainage districts may be formed either by the county supervisors or similarly to the formation of irrigation districts. Levee districts are formed by the supervisors on petition of a majority of the landowners and assessments are levied by the supervisors on an ad valorem basis as determined by the county assessor. On top of all this, for instance, comes the Sacramento and San Joaquin Drainage District whose boundaries are fixed by the Legislature and in which assessments are levied according to benefits by the state reclamation board.

It is presumed, when any of these various agencies that control the management and financing of such enterprises have laid upon the land expenses for drainage or reclamation or irrigation or protection from overflow, that they have given due consideration to obligations already imposed or for which the power to impose existed. Nevertheless, the acute situation resulting from the overlapping of assessments found in certain sections of the State would, in all likelihood, be more favorable to the landowner if the efforts and the agencies in charge were more nearly co-ordinated. Certainly, in the interest of successful land settlement, this overlapping should be more carefully considered in advance in the future than it has been in the past.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

How Can We Stop Duplication of Orders?

Sir—We think a non-cancellable contract would be a great help toward stabilizing the building supply market. Some factories make a practice of booking large orders from speculative jobbers and then raising prices on account of the large volume of business on their books, while this output has actually not been sold to the consumer at all.

The cement industry has recognized this evil and corrected it to a large extent. If other lines would follow their lead it would help very much to stabilize material prices.

G. W. COOPER,
A. & W. Cooper, Dealers in Builders' Supplies.

Detroit, May 21.

Sir—I have read with considerable interest your editorial on the question of duplicating orders with the privilege of cancelling in the event that materials were not needed. It seems to me that your stand on this subject is quite correct. A great many contractors adopt this policy with the idea that they will be in a position to underbid their competitors without any cost or risk to themselves. Should the work not come to them, which is usually the case, they still hold to their advantage, thus keeping their competitors from securing the materials which the manufacturer or supply dealer is holding for the first contractor.

If the policy that you are advocating were adopted, the manufacturer and building material dealer would always be in a position to advise definitely whether prompt delivery could be made on any order placed with them.

Nashville, May 14. E. G. HOLLADAY,
E. G. Holladay Co., Building Construction, Nashville, Tenn.

Sir—I had the pleasure of reading your recent editorial on "How Can We Stop Duplication of Orders." While the points you have raised are deserving of serious consideration and the lack of mutuality in the so-called contract under which materials are now customarily purchased by local dealers and contractors is obvious, the most potent fact governing duplication of orders is one to which no allusion is made. I refer to the fact that, so far as my experience goes, there is no considerable number of manufacturers of building materials, and I presume this refers as well to manufacturers in other lines, which limits the orders booked to production capacity. To put the case from a little different angle, I will hazard the guess that any reputable contractor in New York City, having need for 25,000 bbl. of cement to be delivered at the rate of 1,000 bbl. per week for the next 25 weeks, can obtain without difficulty unreserved acceptance of his order under those terms from practically any over-sold cement mill within shipping radius of New York.

Nor have I referred to cement mills because they are unusual offenders in this particular. I believe their practices in this, as in many other matters, to be rather above the ordinary. If a contractor wished a million board-feet of lumber or a proportionally large supply of brick or lime it would ordinarily be sold to him under specific terms as to delivery without the slightest regard to whether or not delivery could actually be made according to these terms.

From the standpoint of the writer, relief from the present day menace of the duplicate order can most readily be secured by the development of business ethics to a point where the buyer can know that when he receives the acceptance of an order under specific terms of delivery he has received a document which the vendor can and will honor. But, as matters now stand, the ordinary contractor and the small distributor have no means at their disposal for determining whether, in fact, a manufacturer is or is not oversold, and are forced to do business with full knowledge of the fact that, in practice, the average manufacturer will accept almost unlimited orders without regard to whether he can make delivery. It is only when deliveries fail to arrive that the buyer knows that the market is oversold, and in an effort to secure the materials that he needs aggravates the situation by duplicating and reduplicating orders in the hope that he can find a merchant who will sell something that he has, instead of something that he hopes some time to produce.

There are not, in my judgment, 10 per cent of the contractors or distributors in this country today who would ever duplicate an order if the manufacturers by whom orders are accepted would validate their sales by making only such as they know can be shipped under the terms of the orders as accepted. J. L. HARRISON,
U. S. Bureau of Public Roads.

Washington, D. C., May 19.

Sir—Relative to the question of duplication of orders on manufacturers to insure adequate deliveries for construction work, it has been our practice only to protect ourselves for the work we have in contemplation for the immediate future. We have endeavored at all times to carry on our program of work in connection with the manufacturers so that orders will be bona-fide and this procedure has resulted in a mutual understanding which, I think, has been of advantage to both parties. A. J. HAMMOND,
Chief Engineer for James O. Heyworth, Engineer and General Contractor.

Chicago, May 23.

The Pan-American Railway

Sir—In spite of its futility, this project keeps cropping up, as it is one which appeals to the imagination, and although the fallacies have been repeatedly pointed out, it hardly seems wise to let the article published in your issue of May 10 pass without some comment. This seems especially necessary now, at a time when we may venture with some reason to hope that American engineers will be able to take a larger part in the development of transportation in South America, though in order to do this successfully they must keep their feet firmly planted on the ground. A certain amount of imagination is of course very necessary to all engineers, but it must be tempered by the practical, and I am firmly of the opinion that this project cannot be so classed. It is also true that engineers, especially, must look forward to the future and lay their plans accordingly, but this plan I believe is farther in the future than we can look forward to now, and its advocacy by any considerable body of American engineers or business men will only bring them the reputation of being more or less visionary.

The writer's interest in this subject goes back over thirty years to the time when he met and had the pleasure of entertaining, in Columbia, that Nestor of railroad engineers, Col. Wm. F. Shunk, whose field book in those days was our Bible. Col. Shunk was then making the reconnaissance from Quito to Cartagena for part of the then proposed route of the Pan-American line, and the writer was making his first piece of location with only two assistants. This interest has been sustained by contacts with Latin America, extending over all the time since then, during which the Pan-American project, as such, has not advanced a particle, that is to say, no railroad has been built in any of the territory South of the United States because it might form part of this proposed through route from New York to Buenos Aires. (This may be questioned in regard to one or two lines, but in the writer's opinion it is substantially true.)

Of course as time goes on, all the various countries will probably extend their railroads to their borders and establish through rail communications with their neighbors, but

I am firmly of the opinion that this should be done only to further the development of each country and not in pursuance of any plan of through communication unless this latter policy also fits it.

It appeals to the imagination, of course, to take a practically virgin territory as large as is the continent of South America and lay out the lines of future development on a grand scale so that all future work may be planned with an eye to the complete scheme.

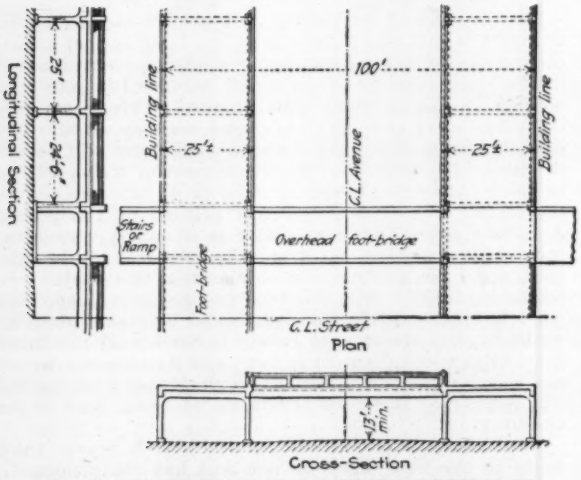
To fully develop all the arguments pro and con in regard to this very large question would take more space than I think you would care to devote to it. It is, however, the writer's opinion, based on a fairly extensive knowledge of South America, that it would be far wiser for those who wish to help in the development of transportation in the Latin American countries, which is the basis of course for all other development, to advocate for each country the development of those lines of communication which will help that particular country, and that without reference to any scheme of a Pan-American railroad. By so doing we will not only show our American practical common sense but be of the greatest help to our neighbors. F. LAVIS,

New York, May 14, 1923. Consulting Engineer.

Elevated Sidewalks of Reinforced Concrete for New York City

Sir—While the improvement in the control of vehicular traffic in New York has greatly relieved what otherwise would be impossible conditions, the problem is far from being solved both as to supplying sufficient roadways for vehicles and as to the protection of the pedestrian from injury or loss of life through the instrumentality of the congestion of vehicular traffic.

The problem is one which cannot be solved by the injection of picayune considerations or the protection of individual interests at the expense of the community at large as the solution must necessarily involve an immense outlay



PLAN AND SECTION OF PROPOSED SIDEWALKS

of money and a temporary disturbance of private property with the resulting inconvenience and temporary private loss.

The accompanying sketch showing a proposed solution of the problem for a typical avenue, more particularly Fifth Avenue, contemplates the elevation of the sidewalk to the second floor level on reinforced-concrete construction of the two-way slab type, providing sufficient headroom to permit of vehicular traffic thus widening the driveway to almost one hundred feet. The present roadway need not be disturbed, the side driveways being pitched toward the present gutters. The main driveway could be restricted to through traffic while the side ways would accomodate local traffic. The shops would further have the advantages of having two stories of display thus increasing the advertising value. The column spacing is made 25 ft. to conform to the normal width of a city lot but is amenable to change. The two-way slab proposed for this structure is an economical type of construction and with an open concrete balustrade would have a very pleasing appearance. If desired the slabs could be precast so as to interfere with business and traffic as little as possible during construction. It then would be necessary to cast only the columns and girders in place. At the street crossings overhead footbridges are contemplated which could be precast and set in place, similar to one of like span that has been constructed and is ready to be set in place in connection with the Lackawanna improvement work at East Orange, and in this way would minimize the obstruction to traffic. At 14th, 23rd, 34th, 42nd and 57th St., it would be advisable to eliminate crossing at grade by elevating the cross streets to the elevation of the proposed sidewalks, while at other streets, either ramps, stairs, escalators or moving platforms could be provided to connect the two levels.

While the arcades recently proposed provide the additional driveway space the method would probably be more expensive and would not solve the problem of protecting pedestrian traffic.

With the introduction of additional longitudinal streets such as have frequently been proposed it will be possible to maintain one-way traffic on the majority of them and thus further relieve congestion and eliminate danger of accident both to vehicles and to pedestrians where sidewalks are not elevated. M. HIRSCHTHAL.

Hoboken, N. J., May 10, 1923.

Conditions on the Polish Railways

Sir—The article in *Engineering News-Record* of March 15, 1923, p. 484, about the railway conditions in Poland gives the general characteristics and is very satisfactory. I would like to add, however, that not only was part of the Russian railway system built for military purposes, but also that the German and Austrian Governments had considerable influence in the laying out of these railways. The Russian Government had to be very careful in what it did and often was unable to build private lines for purely local communication.

The shortage of railway systems in the Russian part of Poland is very great and in comparison with the former German and Austrian parts we see that whereas the German part has 5.9 miles and the Austrian part 3.44 miles, the Russian part has only 1.68 miles for each 38.6 surface miles.

Before the war France had 114 cars, Germany 163, Russia 100, Austria 80, while Poland had only 54 cars for each 6.22 miles of line but, thanks to America, Poland has now some thousands of new locomotives and freight cars.

It will be seen that the war with Russia demanded from the railways an intensity of construction unprecedented in peace times when it is realized that the engineers were required to rebuild in a few days some hundreds of miles of standard-gage track for pushing back into the country thousands of captured cars and locomotives from the Russian system.

After the return of part of Upper Silesia, Poland had not only the difficulty of obtaining cars for handling coal, but had to reorganize her transportation system to make up for the parts that had been turned over to Germany.

Under the Versailles Treaty 49,000 cars and locomotives were returned to Poland, and, thanks to the activity of her government and citizens, they are now in fair condition and traffic will move better. For example, the daily number of running freight cars in January, 1921, was 7,160, in the same time in 1922 was 7,375, and now in January, 1923, is 10,054. Also, the number of cars under repair has been reduced to 16 per cent, a much better figure than last year. In addition to this, Poland is now showing considerable activity in building new railways and preparing for future lines. A part of the loan received from France will be used for this purpose and the government is considering the question of separating the railways from the general budget.

Los Angeles, May 3, 1923. Z. GILLEWICZ.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

According to Figures Compiled by Edwin Mitchell, chief accountant of the Colorado Highway department, $19,813,207 has been expended since the organization of the department in 1910.

On May 17 the Two Headings of the Queensboro extension of the New York Subway met under 42nd St. near 5th Ave. Work on this part of the extension was started on Aug. 1 last and it is expected that it will be completed by Jan. 1, 1924.

Governor Pinchot, of Pennsylvania, has signed a measure which he sponsored, providing for a board to confer with similar boards appointed by New York and New Jersey on regulation of flow in the Delaware River. The measure creates a board consisting of nine members (certain state officers) to survey the power possibilities of the state's water, and to formulate a plan for the best development.

City Planning Projects at St. Paul, Minn., are making slow headway, owing to difficulty in inducing the city council to open new streets or widen existing streets where there is protest from the owners. The councilmen are elected at large, and it is stated that when any considerable group of citizens makes protest against a public improvement that improvement is practically doomed. A review of the extensive program of improvements of the City Planning Board was given in *Engineering News-Record* of Nov. 3, 1921, p. 735.

The Constitutionality of the Water Diversion Tax imposed by the state of New Jersey on all water diversions for municipal supply in excess of the amount used in 1907 has been upheld by the United States Supreme Court in an appeal from a similar decision of the courts of New Jersey. Under an act passed in 1907 such diversions are subject to a state tax of $1 per million gallons. The legality of the tax was contested by Newark and Trenton as regards water diverted from the Pequannock and Delaware Rivers since 1907 for which the state sued to collect totals of $18,104 and $14,310.

Operation of Elevated, Surface and underground lines as a unit system with a single fare and transfers is recommended in a report presented May 21 to the Chicago council committee on local transportation by B. F. Kelker, Jr., engineer for the committee. The report proposes the construction of 205 track-miles of elevated railway, 248 of surface lines, 55 of rapid-transit subways and 2½ of subway for surface cars. The total cost is estimated at $372,830,000. The total mileage of single track would then be 366 miles of elevated line, 1,308 miles of surface line, 55 miles of rapid transit subways and 2½ miles of subway for surface cars.

Wabash R.R. Plans Varied Work

Improvements on the 1923 program of the Wabash R.R., exclusive of rails and track work, represent a total expenditure of $1,120,000. Line changes and bank protection along the Missouri River, including relocation at Randolph, Mo., on account of encroachment by the river, will cost $76,000. For shops and engine terminals there is a total of $248,550, including $150,000 for machinery at various points and $46,200 for terminal extensions at Moberly. Freight yard extensions will cost $76,923. For elimination of grade crossings there is a total of $324,000, of which $150,000 is for work east of Calhoun St. at Fort Wayne, Ind., and $70,000 for Hastings St., Detroit. In the $394,000 for bridges and miscellaneous work there is $115,000 for a plate-girder bridge at O'Fallon, Mo.; $160,000 for bridges with steel girders and concrete girders and slabs; $60,000 for enlarging a dock at Detroit, and $28,000 for building an impounding reservoir for water supply at Stanberry, Mo.

Ford Files Application for High Dam Power

The formal application of the Ford Motor Co. for a license, covering the High Dam project at St. Paul, was filed with the Federal Power Commission May 22 by J. H. Manning, the managing engineer for Stone & Webster. This action is in pursuance to the terms of the preliminary permit which the Federal Power Commission granted the Ford company after the hearing held on March 2.

The application for license was accompanied by detailed plans of the development which appear to have met the Commission's approval. Under the law these plans must be approved by the Secretary of War and the Chief of Engineers, as well, because of the relationship between this project and navigation structures. The War Department has been asked to act promptly on these plans as it is hoped to get the out-of-doors portion of the construction completed during the present working season.

Milwaukee Harbor-Rail Committee Assists Harbor Commission

At the request of the Milwaukee Society of Engineers a committee of representatives from the railroads, civic and commercial associations, and the city government has been appointed to prepare a solution of the problem of coordinating the rail and water transportation facilities at Milwaukee. The engineers on the committee are C. F. Loweth, chief engineer of the C. M. & St. P. Ry.; F. W. Hillman, division engineer of the C. & N. Ry.; J. W. Hyatt, engineer of maintenance-of-way, C., N. S. & M. Ry.; and George H. Boyer, W. J. Sando, and R. H. Pinkley of Milwaukee.

Water-Works Meeting in Detroit Is Record

American Water Works Association Has Large Attendance and Successful Program at 43rd Convention

Engineering News-Record Staff Report

With a membership that has now reached about 1,700 and an attendance of perhaps half of the members of all grades, the American Water Works Association assembled for the forty-third time in annual convention, held what from all points of view was considered a record-breaking meeting at Detroit, Mich., May 21-24. Features of the convention were many reports from sub-committees of the Standardization Council; superintendents' sessions; three sessions of the Chemical and Bacteriological Section, which has asked for a change of designation to "division" to save confusion with the geographical sections; a manufacturers' section at which moving pictures were used to show the manufacture of (1) centrifugally-made cast-iron pipe, (2) a 20-in. Eddy gate-valve, and (3) Johnson brass well screens; and entertainment by the Detroit Water Board and the Water-Works Manufacturers' Association.

Papers and Reports

About sixty papers and committee reports were presented besides many topics handled through the usual question box. It was this last-named feature, under the leadership of Dow R. Gwinn, Terre Haute, Ind., and the technical committee reports presented under the direction of George W. Fuller, chairman of the Standardization Council, that elicited the most discussion.

The technical proceedings are given attention elsewhere in this issue. The main business features are summarized below.

President's Address—The future of the Association, said W. S. Cramer in his address as retiring president, rests largely with the sections. The work of the Standardization Council is valuable. It is making demands on the funds of the Association which would have been larger had not so much of the expense been borne by its members and the membership of the sub-committees.

Honorary Members—Six honorary members were elected as follows: George H. Benzenberg, Milwaukee; Desmond Fitz Gerald, Brookline, Mass.; R. Hering, New York City; William Mulholland, Los Angeles; J. H. Purdy, for many years superintendent of the American Water Works and Guarantee Co. (now American Water and Electric Co.); and Sir Alexander Houston, director of water examinations, Metropolitan Water Board, London, England.

New Officers—The count of the letter ballot showed that the following had been elected as officers for 1923-1924: President, George W. Fuller,

New York City; vice-president, Frank C. Jordan, Indianapolis; treasurer, (re-elected) W. W. Brush, New York City; trustees, C. R. Bettes, Far Rockaway, N. Y., and E. E. Wall, St. Louis. On the Standardization Council it was announced by George W. Fuller, chairman, that Prof. George C. Whipple will be succeeded by W. W. DeBerard, Chicago. The Chemical and Bacteriological Section elected these officers: Chairman, Almon L. Fales, Boston; vice-chairman, Norman J. Howard, Toronto; secretary, Dr. Edward M. Buswell, Urbana, Ill.

Next Convention at Memphis, Tenn.—On the first ballot for the next meeting place of the Association, Memphis, Tenn., and Montreal, P. Q., were far in the lead, with 159 and 148 votes, respectively. Chicago and Detroit had 43 votes each and there were scattering votes for several other places. The second ballot confined to a choice between the two highest cities on the list gave 184 votes to Memphis and 182 to Montreal.

The finances of the Association were shown to be in good shape, with the past year's expenses below the budget allowance, on operating surplus and a $12,000 investment fund. The 1923-1924 budget was fixed at $23,000.

Resolutions—The Association adopted a resolution introduced by Dabney H. Maury, Chicago, urging the Department of Justice to bring to speedy trial the suits against contractors, engineers and others on account of alleged frauds in the construction of army camps during the World War. A resolution urging the city authorities of San Francisco to find some other way to honor M. M. O'Shaughnessy than to name the Hetch Hetchy dam after him in view of the fact that the new Scioto River dam at Columbus, Ohio, was named after Jerry O'Shaughnessy two years ago, was lost.

The Nicholas S. Hill, Jr., cup for the largest percentage of attendance at section meetings during the year was awarded to the North Carolina section for 66.6 per cent of record.

San Francisco Water Supply Is Augmented

To increase the quantity of water supplied to San Francisco from the Calaveras watershed, the Spring Valley Water Co. is reconstructing the Sunol aqueduct through Niles Canyon. The old aqueduct, consisting of about 3 miles of wooden flume and 5 tunnels, whose total length is also about 3 miles, was limited by the size of the flume to a capacity of 21 m.g.d. The present requirement is for 45 m.g.d., but since the tunnels already have a 70-m.g.d. capacity it was decided to rebuild the flume in reinforced concrete of sufficient size to carry 70 m.g.d. The work is already under way and the flume is to be in service in October.

Work is being done on a day-labor basis, under the direction of George A. Elliott, chief engineer, and T. W. Esby, construction engineer of the Spring Valley Water Co.

To supply new resident districts building up at higher levels the Spring Valley company is constructing a reservoir at El. 612, which is several hundred feet higher than any heretofore in service. Only one-half the reservoir is being built at present.

Strauss Bascule Bridge Co. Sues City of Seattle

Claiming breach of contract on the part of the city of Seattle, the Strauss Bascule Bridge Co. of Chicago, to which the city recently paid $45,000 in settlement of claims for alleged infringement of patents, has filed suit for $119,392.14 damages against the city. Of this sum, $100,000 is demanded by the company because City Engineer J. D. Blackwell is accused of having made a "libelous statement" that "The Strauss design is not equal to the city design, and if it were made equal it would cost more than the city design." The sum of $19,392.14 is asked, as representing five-tenths of the savings which the company alleges would have resulted by the construction of a Strauss type bridge across the West Waterway at Spokane St., and which the city had agreed to pay the bridge concern. This saving, the company charges, would have been effected "within the limits of the specifications and standard bascule bridge practice."

Portland Cement Association Expands Work

Further expansion of its promotional activities, through the establishment of four new district offices, was announced at the Spring Meeting of the Portland Cement Association in St. Louis last week. These offices will be located in Birmingham, Memphis, Raleigh, N. C. and Jacksonville, Fla. The institution of these offices is largely due to the expansion of mill capacity in the Southeast.

It was further announced that the association will undertake an elaborate celebration next year of the 100th Anniversary of the granting to Joseph Aspdin in England of the patent on portland cement. Full plans have not yet been worked out but it is intended to ask British cement manufacturers and British engineers to come to this country to participate in the ceremonies. Advantage will be taken of the occasion, as well, to promote the relations between America and Great Britain. Aspdin's patent was granted in October, 1824.

Of technical interest were papers on "Possibility of Improving Hydraulic Cements," by P. H. Bates, of the Bureau of Standards, and one on "Fuel Economy in Cement Mills," by O. Lellep, of the Giant Portland Cement Co. The report of the committee on Accident Prevention showed gratifying decreases in the accident records of practically all the mills. Hereafter a tablet will be awarded annually to the mill showing the best safety record.

This year's annual meeting of the association will be held at the Hotel Biltmore, New York City, Nov. 19-21.

The dinner closing the meeting was made notable by an address by Floyd W. Parsons, of the *Saturday Evening Post* and formerly editor of *Coal Age*, and by a moving picture exhibition by Albert Y. Gowen, formerly vice-president of the Lehigh Portland Cement Co., showing his trip around the world in the motor yacht *Speejacks*. The film, in seven reels, represents but 7,000 ft. of the 92,000 ft. of film taken by Mr. Gowen in his fourteen months cruise. Most notable were his pictures of inaccessible and rarely visited tribes in the South Sea Islands.

Suspension Bridge Truss Fails Under Heavy Load

Temporary Repairs Are Made to Structure Over Ohio River at Steubenville

On May 16 a stiffening truss failure occurred in the highway suspension bridge across the Ohio River at Steubenville, Ohio, when a heavy load was on the bridge. Sharp distortion of the structure developed, subsiding again after the load was removed. Various weaknesses in the construction of the bridge contributed to the accident. Temporary repairs have since been made.

The structure has a channel span of 680 ft. and side spans of 260 ft., with floor hangers spaced 16 ft. The stiffening trusses are interrupted by expansion joints at the center of the main span. The trusses are 20 ft. deep at midspan and anchorages, and about 35 ft. at the towers.

At the time of the accident several heavy cars of cinders were on the bridge. It is reported that the floor of the west shore span suddenly sank about 8 ft., and that of the channel span rose correspondingly. After removal of the cars the structure recovered its normal shape.

An engineer who visited the bridge shortly afterward found no appearance of movement in the tower or cables, although the saddles are housed in and could not be examined. Near midspan of the west shore span, the top chords of the stiffening trusses were broken, one in the seventh panel and the other in the eighth panel from the shore end. The top lateral system in the same region was badly distorted. The bottom chord buckled on a length of three panels between the break and the abutment; the bottom lateral bracing in this region had been cut during some earlier reinforcement operations. The top lateral system in the vicinity of the break in the top chord was greatly distorted.

Stiffening Truss Chord

The top chord of the stiffening truss is a T-shaped section built up of wide, thin plates and small angles. The top lateral struts are very slender T-shaped sections, while stay-struts at the crossing points of the top lateral diagonals are better designed for compression, being latticed members, but are not part of the lateral system proper. There is practically no effective sway bracing, small curved angle knees connecting the posts and the slender T-struts.

In three panels lying between the break and the abutment, new floorbeams had been inserted at some time in the past between the regular floorbeams. These new beams, suspended directly from the cables, support the stringers at mid-panel. The bottom laterals, however, which interfered with the insertion of these new floorbeams, were cut apart to permit of inserting these beams, being burned off on either side of the new floorbeams. In these three panels the bottoms chord buckled, and at least one of the laterals is badly distorted, showing the need of the lateral bracing.

From the local examination it was concluded that the failure is chargeable primarily to a twisting action occurring under excessive one-sided load, distortion being favored by the weak and lateral and sway systems.

New Jersey Organizes Building Congress

First State Organization to Bring All Elements of Industry Together Formed at Newark

For the first time in the history of the building congress movement a state section was organized when, on May 28 at Newark, the New Jersey Building Congress was formed. The northern part of the state had been considering for some time the organization of a congress but construction men in other parts of the state displayed such enthusiasm for the plan and the opinion was so general that the interests of the entire state were bound up together that it was decided to form a state-wide organization. The formation of subsidiary local bodies in the important cities of the state is to come up for early consideration.

The new congress becomes the New Jersey Section of the National Congress of the Building and Construction Industry. The six basic elements of the industry, promotion, design, construction, labor, materials supply and "general interest," and all parts of the state were represented at the organization meeting. Question was raised and referred to the executive committee as to the advisability, because of their importance in New Jersey, of designating building and loan associations as a distinct element. Committees on codes, arbitration, seasonal employment, standards, surveys and apprenticeship were authorized. Individual dues were set at $15, association and corporation dues at $25, and sustaining, at $100.

TEMPORARY OFFICERS

The following temporary officers, to serve until the next annual meeting next October, were elected: President, Harry T. Stephens, architect, Newark; vice-presidents—Joseph F. Eilbacher, builder, Elizabeth; William Burton, builder, Trenton; Arthur Quinn, labor, Rahway; Henry Sands, labor, Newark; Donald McClave, materials supply, Harrison; E. J. Mehren, "general interest," South Orange; treasurer, Frank E. Quimby, Newark; secretary, S. George Webb, secretary, Building Trades Employers' Association, Newark. Additional elective members of the executive committee are T. Yorke Smith, building and loan association league, Camden; Wesley A. O'Leary, assistant state commissioner of education, Trenton. The chairmen of all committees, to be appointed by the president, will be *ex-officio* members of the executive committee.

Robert D. Kohn, of New York, chairman of the national organization, presided at the meeting.

Test Case on Highway Contract Cancellations in California

The right of the new California State Highway Commission to cancel contracts entered into by the old commission, with or without the consent of the contractor, is being tried out in an action recently brought in the Supreme Court of that state in connection with a contract made between the George Pollock Co. and the former California State Highway Commission for road construction in Monterey County.

San Francisco Material Dealers Acquitted of Charges

Thirty-four building material dealers of San Francisco, prosecuted for refusing to sell materials to contractors who would not support the American plan, were recently acquitted in the California Supreme Court within thirty minutes after the case had been put in the hands of the jury.

The prosecution of this case was "union labor's attack upon the American plan," according to the Industrial Association of San Francisco, which points out that the result is "a victory of nation-wide importance that should redound materially and permanently to the benefit of every community that seeks to free its industry from autocratic class control and to secure the ultimate good of all labor, union and non-union, as well as of industry itself."

In the conduct of the case the defense frankly admitted withholding materials from the enemies of the American plan but contended that this had aided the community and had been done with that end solely in view. The defense showed that the city had prospered tremendously under the American plan—whose benefits had even flowed in the form of steady work and high wages to the men whom the prosecution claimed were agrieved.

"The findings of this jury," the Industrial Association states, "by upholding the doctrine that the general good of the whole community must be put above advantage to any one class, perpetuate the complete industrial freedom which San Francisco fought so long to obtain."

Previous reference to the rise in popularity of the American plan in San Francisco was published in *Engineering News-Record* Sept. 8, 1921, p. 427.

Portland City Council Approves Waterfront Development Plan

The City Council of Portland, Ore., has passed an ordinance adopting the report of O. Laurgaard, city engineer, in which a plan is outlined for developing the waterfront opposite the business district of the city, to cost altogether about $11,163,000. The plan includes a fill made with material dredged from the river channel, the elevation of bridge approaches and the construction of a sea-wall, interceptor sewer, market buildings, terminals and other structures. Special consideration was given to the plan at this time because some such improvement will be highly desirable in connection with laying out the West approach to the new Burnside bridge.

Of the total cost of the project the City of Portland would bear about $800,000, according to the city engineer's report, the balance to be borne by the railroads and by the corporation which it is suggested should be formed to carry out the project. No date has been set for beginning the work.

Interested property owners have organized for the purpose of furthering the project and are urging the immediate construction of the interceptor sewer and the concrete sea wall as the first stage of the project. The cost of this part of the work has been estimated at $2,000,000 and would be assessed to the property benefitted.

Penn State College Holds Industrial Conference

Co-operative Technical Education, Summer Employment, Need for Engineers, Among Topics

The fourth annual conference between the industries of the state and the college of engineering was held at Pennsylvania State College, May 25-26, with about one hundred in attendance. These conferences, under the direction of R. L. Sackett, dean of engineering, are intended to inform the industrial leaders as to the work going on at the college and at the same time to develop ideas to guide the faculty in the conduct of its work. This year the conference overlapped a preceding conference on engineering extension courses and was itself devoted mainly to three subjects: co-operative technical education, summer employment for undergraduate engineers and the prospective need for engineers.

Co-operative instruction was discussed by Dean Sackett in a paper which will be abstracted in an early issue of *Engineering News-Record*. In the floor discussion the trend of opinion was not particularly favorable to this newly-developed form of collegiate training. The main objection by the representatives of industry seemed to be that the alternate school and shop method imposed unnecessary hardship on the industry because of the necessity of treating the students more as students than as workers. This hardship, it was admitted, has lessened as the term of alternation is increased above the two weeks of the first schools of this sort.

SUMMER EMPLOYMENT

Summer employment was advocated both by teachers and industrial men, but the sentiment was in favor of the boy going into the elementary processes for his first two summers, leaving the last summer for organized instruction and work looking toward his general education in the methods of the employing company. This, according to G. H. Pfeiff, of the General Electric Co., is the system in vogue in his company. R. G. Manning, of the Ambridge plant of the American Bridge Co., said the boy seeking summer employment too frequently wants to get into the designing department, whereas his own education as a structural engineer would be better furthered by two summers in the shop and on erection, though probably he would not get out of that much more than his board.

F. J. Chesterman, chief engineer of the Bell Telephone Co. of Pennsylvania, presented an analysis of the personnel of several of the largest telephone companies which showed that the technically trained man got ahead in all branches of that industry much faster than did the non-technical man. The demand for the future engineering graduate is constantly increasing, he thought, but there is a growing place for extension and correspondence school work in the industrial organization itself to take care of the demand for what might be termed the non-commissioned officers of industry.

At Pennsylvania State College this year the demand for engineering graduates is far ahead of the supply. The seniors are picking the most attractive of many jobs offered.

Random Lines

The city council has appointed August J. Van Gemert, bricklayer, assistant city engineer, the appointment coming after a prolonged argument regarding authority to make such appointment.—From a Rochester, Minn., paper.

The union scale for bricklayers at Rochester must be lower than in most places.

* * *

One Way Out

"I see you are going to talk about the transportation problem," said Will Rogers to some business men in convention at New York last week. "The trouble is, of course, that there is a lack of rolling stock since the war. I'll tell you how to solve that. Stop this running around to conventions and stay at home and the railroads won't be so congested."

* * *

"At the suggestion of Secretary Weeks, War Department officials charged with drawing up industrial mobilization plans are working out a 'don't' chart, based on war experience and setting out those things done during the war which it is most desirable to avoid in any future war emergency. Men in civil life who handled the big supply and equipment problems of the war are coming forward, it was learned today, with examples taken from their own experience of things most essential to avoid, based on errors committed during the war."—Washington dispatch.

The seven engineers who came in to help out the war construction program and whom Mr. Daugherty has indicted as criminal conspirators ought to have something to offer.

* * *

"Visionary Side To Be Made More Attractive," reads a headline to an article on apprentices in the News Letter of the Associated General Contractors. That's good news. Heretofore most contractors have thought that only engineers were visionaries.

* * *

There Are Screens and Screens

Rodolph Valentino doesn't like civil engineers. He says they are cramping his style. "What does a civil engineer or a prize-fight promoter know about art," he asks. "That is just what is the matter with so many pictures today. There are too many plumbers, engineers and prize fight promoters trying to tell the directors what to do. These men take the art out of the moving picture production. I know of one instance where a civil engineer killed some of the most wonderful scenes in a production after they had been filmed. He was behind the picture, though, and his word was law. That will ruin pictures."

* * *

A town in Florida has appointed a "mosquito engineer." A lot of frequenters of summer resorts want to know what a mosquito needs of an engineer.—*Detroit News.*

Appenines May Be Pierced by 11¼-Mile Railway Tunnel

According to a recent issue of *Commerce Reports* the Italian State Railway Administration is considering a proposal to construct a tunnel 11¼ miles long on the direct line between Florence and Bologna on which considerable work has already been done by the government. The tunnel would penetrate the Appenines on a line connecting the towns of Pianoro, on the Bologna side, and Prato, on the Tuscan side. The estimated cost of this undertaking is placed at between $30,000,000 and $50,000,000, at present exchange rates.

Tunnel Holed Through on Hetch Hetchy Project

On May 15 the tunnel heading being driven west from Early Intake on San Francisco's Hetch Hetchy water supply project met the heading being driven east from South Fork. This tunnel is about 24,000 ft. in length and is the longest stretch driven from two headings on the mountain division. In view of the precipitous nature of the route traversed by the survey over the tunnel it is notable that the two headings came together with a discrepancy in distance of only 0.8 ft. The difference at the meeting point of grade, as carried in from the two ends, was 0.02 ft.; the two lines differed in alignment by 0.59 ft.

Extend Temiskaming & Northern Ontario Ry. to Hudson Bay

It has been decided by the Temiskaming & Northern Ontario Railway Commission to continue the extension of its main line northward to a terminal at the mouth of the Moose River on James Bay, the southern end of Hudson Bay. Work on the first 70 miles north from Cochrane, Ont., is being carried on by Grant Smith & Co. & McDonnell, Vancouver, B. C., and it is expected to have this completed in 1923. Bids for the further extension will be called for probably in July or August. A 20-mile branch is to be built from Swastika to Ladder Lake and it is expected to call for bids in June for this work. All work is under the direction of S. B. Clement, chief engineer.

Erie R.R. Improvements for 1923

Improvement work on the Erie R.R. during the current year is to include six miles of relocation near Wanaque-Midvale, N. J., on account of the new reservoir formed by the construction of the dam for the North Jersey Water Supply District. Grade crossing elimination will be carried out at Buffalo and Jamestown, N. Y., and Akron, Ohio; while pedestrian subways will be built at Phelps St., Youngstown, Ohio, and at Oak Hill, Endicott, N. Y. Ten miles of second track will be laid on the River Division east from Cuba Junction, N. Y., and an open pier 100 x 680 ft. will be built at Weehawken, N. J. Other items include passenger and freight stations and team tracks at Englewood, N. J.; station at Passaic Park, N. J., and Hamburg, N. Y.; an erecting shop 408 x 108 ft. at Hornell, N. Y.; power house at Jersey City; coaling station at Avon, N. Y.; and a water station with 50,000-gal. tank at Alger, Ohio.

New York Highway Work Is Curtailed

After a conference with his nine division engineers Commissioner of Highways Frederick Stuart Greene, of New York State, has decided that, in the interests of the state, it is necessary to curtail further new construction until the vitally necessary reconstruction work has been provided for. The state has now in force 217 highway contracts amounting to more than $28,500,000, on which less than $9,000,000 of work has been performed. In addition to this uncompleted work, the department will make every effort to award contracts amounting to $5,000,000 for the reconstruction of old roads which have gone to pieces. This proposed reconstruction work added to contracts now unfinished will total $24,500,000, which is more road work than the department has ever accomplished in any one year.

The conditions which have militated against taking on new construction are freight embargoes, scarcity of materials and shortage of labor. Commissioner Greene realizes, according to his own statement, that the policy of continuing to raise prices, in an effort to encourage contractors to submit bids, would not only make it impossible for firms now working at lower figures to complete their contracts, but would rob already undermanned farms of necessary labor. He has determined, therefore, that except for a few important connecting links and some heavy grading contracts, there will be no more new construction attempted until the abnormal conditions in transportation, material and labor have passed. It is estimated that postponement of new work means the deferring of $16,000,000 worth of highway construction which had been contemplated earlier in the season.

The postponement of new work will not affect, however, expenditure of the $10,000,000 authorized for the construction of rural post roads under the federal-aid plan.

New York State Bridge Survey Act Signed by Governor

The Ames bill, appropriating $15,000 and authorizing the commissioner of highways of the State of New York to make a survey of bridges on state and county highways and to report to the legislature of 1924, was signed by Governor Smith last week. The latest available data on the capacity and condition of bridges throughout the state is contained in the legislative committee report rendered in 1915. At that time it was discovered that more than one-half of the important bridges in the state were of less than 15 tons capacity.

According to the bill, the survey can be made either by the forces of the commission of highways or under the direction of the highway commissioner by a competent engineer and assistant to be selected by him. Not only shall a survey of existing bridges be made, but recommendations are to be submitted for needed changes or alterations.

The report is to be in the hands of the legislature on or before March 1, 1924.

Engineering Societies

Calendar

Annual Meetings

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION; Annual Convention, Ithaca, N. Y., June 20-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual Meeting, Atlantic City, N. J., June 25-29.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, Annual Convention, Chicago, July 11-13.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Burlington, Vt, Sept. 18-21, 1923.

The Texas State Highway Association, at its annual meeting in Dallas recently, re-elected W. F. Crawford, Waco, as president, and elected George C. Holmgreen of San Antonio and Col. L. G. Wortham of Ft. Worth vice-presidents, and L. W. Kemp of Houston and Fred E. Rightor of San Antonio directors. A $35,000 budget to secure passage of a proposed constitutional amendment to place highway control with the state in order to secure Federal aid was adopted.

The Louisiana Section of the American Society of Civil Engineers at its recent annual meeting elected the following officers: E. H. Coleman, president; S. M. Young, first vice-president; E. S. Bres, second vice-president; and re-elected Frank A. Muth, secretary, and C. M. Bott, treasurer.

The St. John Branch of the Engineering Institute of Canada, which has a membership of 75, at its annual meeting elected for the coming year: president, H. F. Bennett; vice-president, G. M. Hatfield; secretary-treasurer, W. J. Johnston. Arrangements were made for a general meeting of engineers of eastern Canada to be held in St. John in September.

Personal Notes

COL. N. H. BALFOUR, formerly assistant to Sir Henry Thornton on the Great Eastern Ry. in England, is now an assistant to Sir Henry in the management of the Canadian National Ry.

ELBERT G. ALLEN, formerly chief engineer of the Philadelphia Rapid Transit Co., is now consulting engineer with Stone & Webster, Inc., Boston, Mass.

EDWARD H. WHITTEMORE, formerly manager of the heating department of the Boston office of the Lord Construction Co., has entered the structural division of Stone & Webster, Inc., Boston, as engineer.

WALTER R. EGGLESTON, of Black River, N. Y., engineer in Division 3 Highway Department, Watertown, N. Y., has been appointed superintendent of highways of Jefferson County with headquarters at Watertown. Jesse E. Kelsey will continue as assistant in Jefferson County.

E. R. CONANT has resigned as surveyor in the New Hampshire Highway Department. He intends establishing consulting engineering offices in Boston.

MORTON C. TUTTLE, general manager of and for twenty-five years with the Aberthaw Construction Co., Boston, has organized and is president of the Morton C. Tuttle Co., Boston, which will engage in general building and water-power construction. With him are associated Nathaniel McL. Sage, Clayton W. Mayers, and Lyle M. Richardson. Mr. Tuttle, during the War, organized the Emergency Construction Committee subsidiary to the War Industries Board, and later served the Fleet Corporation in supervision of production, purchase, transportation and storage operations.

BANKS & CRAIG, an engineering firm of Harrisburg, Pa., has been selected as engineer for the borough of Lewiston.

K. E. MCCONNAUGHAY, assistant maintenance engineer for the Indiana Highway Commission, is to become chief engineer for the Hayes Construction Co., Indianapolis. This company announces an improvement in service in the way of providing engineers, plans, etc., for cities not large enough to have a city engineer but too large to have the use of the county surveyor; it will also conduct a series of tests of many kinds of pavement for service in Indiana.

B. J. PARDEE, civil engineer, has been appointed city manager of Visalia, Calif.

J. P. IRONS has been appointed division engineer of the eastern division of the Kansas State Highway Commission. Mr. Irons was overseas with the 110th Engineers, and has been for several years county engineer of Anderson County.

SAMUEL L. GATSLICK, recently with the Raymond Concrete Pile Co., has taken offices at 130 E. 59th St., New York City, and will engage in engineering and contracting.

SAMUEL S. OMAN and SAMUEL LILIENTHAL, Chicago, have formed a partnership for the practice of architecture and engineering, with offices at 64 West Randolph St., Chicago.

RAWSON COLLIER, until recently sales manager of the Central Hudson Gas and Electric Co., has joined the organization of Dwight P. Robinson & Co., Inc. Mr. Collier's previous connections were with Collier & Brown, consulting engineers, Atlanta, and the Georgia Railway and Electric Co.

L. P. SCOTT, G. L. CAMPBELL, and A. A. ANDERSON, division engineers of the southeastern, northwestern, and south divisions, respectively, of the Kansas state highway commission, and O. J. EIDMANN, assistant engineer in charge of bridges, have resigned, effective May 1.

LIEUT. COL. GEORGE R. SPALDING, Corps of Engineers and instructor at the Army War College, has been ordered to Florence, Ala., for duty on the Muscle Shoals project. He will relieve COL. WILLIAM H. BARDEN, who, having completed the regular tour of duty on the Alabama station, has been ordered to Seattle, Wash.

A. B. WEST, who has been connected with the Southern Sierras Power Co. of California, has been elected president and general manager to succeed the late Guilford S. Wood.

OTTO B. KIBELE, who recently resigned as works manager of the Los Angeles, Calif., Shipbuilding and Drydock Corp., has been appointed manager of the Los Angeles plant of the Bethlehem Shipbuilding Corp., succeeding James Stewart. Mr. Kibele is a member of the Los Angeles harbor commission.

GEORGE LEWIS has been appointed city manager of Tulare, Calif.

J. WALDO SMITH has been selected as consulting engineer to Fuller & Maitland, engineers for the new water supply works of Kansas City, Mo., the detailed design of which will be under the immediate charge of J. R. McClintock of Fuller & McClintock. R. M. Merriman is chief engineer for Fuller & Maitland, whose staff includes A. R. Holbrook, A. L. Maitland and Wynkoop Kiersted, Jr. On May 16 Kansas City sold $2,500,000 worth of bonds and received an informal bid on the entire $11,000,000 issue voted last year.

JOHN ERICSON, consulting engineer for the City of Chicago during the last political regime, has been reappointed city engineer, succeeding Alexander Murdoch. The latter has been suspended pending the filing of charges before the civil service commission by the commissioner of public works, Col. A. A. Sprague. Mr. Ericson entered the employ of the city nearly forty years ago as draftsman in the water department.

MAJOR W. H. RADCLIFFE has been elected president of the Compass Oil Co. which has a large oil well and other holdings near Corpus Christi, Texas. Major Radcliffe was engineer of the municipal bridge at St. Louis for the American Bridge Co., and recently has been in charge of construction work at the Fitzsimmons Hospital, Aurora, Colo.

Obituary

ELISHA H. TALBOT, retired publisher and founder of *Railway Age*, died May 22 in New York City, aged 83 years. He was born in Ohio, and at the age of 19 established a weekly newspaper in Winterset, Iowa, and during the Civil War served as secretary in Washington to the congressman from his Ohio district. Besides *Railway Age*, he founded a magazine called *The Great West*, and another, *The Club Woman's Magazine*.

LYNN S. ATKINSON, structural engineer and general contractor, died recently in Santa Monica, Calif., aged 58. Among his foremost works are the Polytechnic High School at Long Beach, Calif., the Broadway tunnel, and extensive street and road work in the Imperial Valley and on other California highways.

JOSEPH T. RAYCRAFT, building inspector and former president of the Long Beach Construction Co., died at Long Beach, Calif., May 2. He was born in Ireland and came to the United States when 17 years old.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Varied Products Shown at Water-Works Exhibit

Sixty-Five Manufacturers Represented at Detroit Convention of American Water Works Association

SIXTY-FIVE manufacturers of water-works equipment and materials ranging in scope from the sensitive mechanism of a long distance water-stage recorded to the large-diameter steel pipe, high-pressure pumping plant, or large capacity tank or standpipe exhibited their products at the forty-third annual convention in Detroit, May 21-25, of the American Water Works Association. The displays covered all of the major fields of water-works practice and for purposes of classification may be divided into eight groups, including pipe and fittings, meters, valves and hydrants, pumps and accessories, chemicals and apparatus for water treatment, filters, tanks and standpipes, and miscellaneous tools and equipment, including measurement and control apparatus. In addition, six engineering publications in the water-works field were represented. On the basis of the number of displays, pipe and fittings took first place with 16 manufacturers represented, while meters were second with 14, and valves and hydrants third with 8.

Pipe and Fittings

A wide range of products was shown in the exhibits of pipe and fittings. In addition to cast-iron there were steel and concrete pipe and lead-lined and tin-lined pipe. Several displays featured special joints, such as the Dresser, the Universal, and the McWane —the latter a pre-calked joint—while the field of jointing materials was represented by Leadite. Among the manufacturers of large-diameter steel pipe were the East Jersey Pipe Co. with its lock-bar design, and the National Tube Co., the latter featuring its recently developed hammer-weld pipe for diameters ranging from 20 to 96 in. In addition to the pipe displays were numerous exhibits of special castings and iron and brass fittings.

In the field of pipe and fittings, the manufacturers represented included American Cast Iron Pipe, Central Foundry, Lead Lined Iron Pipe, Leadite, McWane, Glauber Brass, H. Mueller, Hays, National Tube, United Brass, U. S. Cast Iron Pipe & Foundry, Warren Foundry, R. D. Wood & Co., S. R. Dresser, East Jersey Pipe, and Lock-Joint Pipe.

Meters

For measuring both large and small flows of water through pipe lines and in open channels a wide range of meters was exhibited, including the disk, turbine and compound types for domestic and industrial use, and large Venturi meters of the type employed at Detroit's new filtration plant now under construction. Several manufacturers featured the frost-proof, split-case meter. Some of the meters shown were designed for recording the flows of hot water and oil. Meter boxes were featured by several exhibitors in addition to current meters for registering flows in open channels.

The meter and accessory exhibits included those of the following companies: Badger, Builders Iron Foundry, Federal, Ford Meter Box, Gamon, H. W. Clark, Union, Buffalo, National, Neptune, Pittsburgh, Simplex, Thomson and Hersey.

Valves and Hydrants

Both high pressure and low pressure valves of sizes ranging from hand-operated types to the large motor-operated valves were an important feature of the exhibit. One manufacturer showed indicator valves for automatic sprinkler equipment, and a number of special valves were on display for use on pipe lines carrying chemical solutions. For large pipe lines the application of air valves to prevent the collapse of pipe during heavy drafts of water was illustrated. Fire hydrants with special drainage equipment and other features to prevent freezing during winter weather completed this feature of the show. The Eddy company displayed an aluminum model of its fire hydrant.

In the field of valves, hydrants and other accessories the manufacturers included Kennedy, Ross, Simplex, Rensselaer, R. D. Wood, Water Works Equipment, Eddy, W. P. Taylor, Columbian Iron Works, and Volkhardt.

Pumping Equipment

The field of water-works pumping equipment was represented by comparatively few manufacturers. Centrifugal pumps were featured by Worthington, while the air lift had the Sullivan Machinery Co. as its sponsor. Equipment for deep well work was on display by Layne & Bowler, while a large well screen was shown by Edward E. Johnson, Inc. In the exhibit of the Birch Manufacturing Co. were pump valves of various types.

Water-Works Chemicals and Equipment

Its latest vacuum type of chlorinator for water supplies was featured by Wallace & Tiernan. In this newly developed equipment the chlorine gas, from the time it enters the apparatus until it is made into chlorine solution, is always under a vacuum so that the possibility of escape is reduced to a minimum. Furthermore, the flow of chlorine automatically ceases whenever the water supply to the apparatus is shut off. Manufacturers of chemicals employed in sterilizing or otherwise treating public water supplies were Mathieson Alkali Works, Electro-Bleaching Gas, Pennsylvania Salt, and Electrolytic Chlorine.

Filters

Two filter manufacturers, Roberts and New York Continental Jewell, had their products on display. The New York company is featuring the Wheeler false bottom for mechanical filters. In addition, the company showed one of the operating tables of the new Detroit filtration plant equipped with the latest type of indicator-register-recorder gage made by the Builders Iron Foundry. The Roberts company manufactures both water filtration and softening plants.

Tanks and Standpipes

In the field of water-works tanks, towers, and standpipes the representatives at the Detroit meeting were the Chicago Bridge & Iron Works and the Pittsburgh-Des Moines Steel Co. Emphasis was given to the varied uses of elevated tanks in water-works practice, including not only use for fire protection but as a means of insuring more economical operation of pumping plants by providing storage capacity.

Miscellaneous

Exhibits not previously classified included water-stage recorders, measuring equipment and surveying instruments by W. & L. E. Gurley; remote control apparatus for valve operation by Payne Dean; tapping machines and other tools by A. P. Smith; water waste surveys equipment by the Pitometer Co.; water-main cleaning equipment by the National Water Main Cleaning Co.; adding machines for water-works accounting by Elliott-Fisher; and testing and analysis by the Pittsburgh Testing Laboratory.

The engineering publications in the water-works field represented at the convention were *Engineering News-Record, Public Works, American City, Engineering & Contracting, Fire & Water Engineering* and the *Canadian Engineer*.

New Officers

At its annual meeting, May 23, the Water Works Manufacturers Association elected as its president John Regan, of the Neptune Meter Co., New York. C. R. Wood, of R. D. Wood & Co., Philadelphia, was named vice-president. Denis F. O'Brien, of the A. P. Smith Manufacturing Co., East Orange, N. J., treasurer, and John A. Kienle, of the Mathieson Alkali Co., New York, secretary.

The committee in charge of the exhibit of equipment and materials at the Detroit convention was headed by George McKay, Jr., of the Leadite Co., Philadelphia, and included J. D. Capron, U. S. Cast Iron Pipe & Foundry Co., Burlington, N. J., and C. C. Behney, Simplex Valve & Meter Co., New York. Next year's exhibit and convention will be held in Memphis, Tenn.

Goldschmidt, Inventor of Thermit Welding Process, Dies

Prof. Dr. Hans Goldschmidt, inventor of the Thermit process for welding iron and steel and for producing high grade metals and alloys, died suddenly in Baden-Baden, Germany, May 20, 1923. He was born in Berlin, Germany, Jan. 18, 1861 and studied at the universities of Berlin, Leipzig, Heidelberg, Strassburg and at the Institute of Technology at Charlottenburg. In 1887 he entered the firm of Th. Goldschmidt, Essen Ruhr, Germany, in joint partnership with his brother Dr. Karl Goldschmidt. Prof. Goldschmidt visited this country frequently and was president from 1904 to 1916 of the Goldschmidt Thermit Co., now the Metal & Thermit Corporation, New York.

Equipment Users Close Discussion on Record Runs

Their Views Agree with Those of Manufacturers—Average Performance Better Than Sprints

For a number of weeks manufacturers have been giving their views in these columns on the subject of featuring record runs or performances of construction equipment and machinery. The consensus of opinion condemns this practice. In this week's issue the discussion is brought to a close by the following contributions from representative users of equipment from whom "Engineering News-Record" requested an expression of opinion:

By W. A. Rogers
President,
Bates & Rogers Construction Co., Chicago

IN MY OPINION record runs or performances of construction equipment should not be featured by manufacturers in their advertising or other trade literature. They are sure to be misleading, as the conditions under which they were made have a very important bearing and these conditions will not be set forth. Average runs, however, are of considerable value.

By R. Peterson
Henry W. Horst Co., General Contractors,
Rock Island, Ill.

THE policy adopted by some manufacturers of construction equipment with regard to judicious advertising is highly commendable and indicates a broad-minded viewpoint as to the responsibility and service of the manufacturers in the construction industry. It is apparent from the expressions that have already been gathered from these various manufacturers that very definite policies have been adopted regarding the advisability of advertising record runs or performances of construction equipment. The consensus of opinion seems to be that the publishing of record runs is not a desirable form of advertising.

In construction work no two jobs are identical in solution as to methods of performance and combination of equipment to be used. Every new job is a particular problem in itself which has to be solved in its own way. For this reason the kind of equipment used in the different jobs will vary in combination as to methods of operation, organization used in performance and degree of hard usage required. The natural elements of the job are never the same. The local conditions are always at variance and the human element entering into the performance is never constant.

Under such conditions it is no more than natural for the experienced constructor to hesitate in placing much value upon advertised record performances. Experience has taught us that performance accomplished in one organization with a certain piece of equipment and under certain conditions would fall down when applied in another organization under the same conditions, due to the one big factor of the human element which enters into the operation and maintenance of the equipment. If, at the same time, the factor of local conditions varies in the two cases, the difference in the performance of equipment becomes even greater.

Where the advertising of record runs by equipment manufacturers has been brought to our attention, we have usually read such advertisements with interest but we have never placed great value upon them in concluding the purchase of equipment. We fully believe that the statement of K. H. Talbot, of the Koehring Co., relative to the manufacturer's responsibility creates a sound basis of advertising, which he expresses in the closing paragraph as follows: "* * * a manufacturing company may offer to a constructor a suggestion based on past experience but it cannot take the responsibility of furnishing figures on which an estimate of cost can be based." And this responsibility is fully realized when it is stated that the "manufacturer of construction equipment cannot possibly know the conditions surrounding the individual construction jobs and for this reason he should never furnish information that will be used as means of arriving at an average figure for work based on maximum runs over short periods." A policy of advertising based on the above conditions is absolutely sound from the constructor's standpoint.

By Arthur S. Bent
Past-President,
Associated General Contractors of America
and President Bent Bros., Contractors,
Los Angeles

MY ONLY comment on the whole subject is that I feel quite unfriendly to advertisements which publish record performances. They are misleading and, in most cases, distinctly against the contractor's interest, as I see it. I am referring the matter to the manager of our local chapter in order that he may get the reaction of other members and forward the whole to you. [The communication referred to follows.—Editor.]

By E. Earl Glass
Executive Secretary
Southern California Chapter,
Associated General Contractors of America,
Los Angeles

A GREAT majority of contractors will take the reasonable view that a record or "sprint" performance should be strictly barred from advertising pages in the leading technical and trade journals. Mr. Talbot touched upon a point which we believe is the principal objection to the practice of showing unusual performance in manufacturers' advertisements. It is well known that such statements (which are sometimes so presented that they are actually misstatements) make the greatest impression upon the uninitiated who accept the figures at their face value. This accounts for many ridiculously low estimates by young engineers and disastrously low bids by budding contractors. The experienced engineer or contractor is not misled nor greatly impressed by such accounts of record performance, so it is our belief that nothing but harm can result from such misleading data.

There seems to be an increasing desire on the part of some engineers in charge of public work to eliminate the contractor from such construction work under the pretext of "saving the contractor's profit." It is a question whether this is due to the socialistic tendency of the times or to an ambitious desire on the part of over-confident youth to learn the contracting business at public expense. Such glowing accounts of construction performance may mislead the officials into believing they can do the work for a small part of the contractor's price. If they do not actually reject reasonable bids from responsible contractors and undertake the work by force account they would at least feel that the contractor was obtaining an exhorbitant profit, whereas he might actually, and usually does, have to play in luck together with very good management to obtain 10 per cent above his actual costs as his own compensation.

It may be profitable to the manufacturers to encourage engineer and public officials to purchase equipment and operate their own construction department, but all business men are convinced that this practice is not in the public interest and if it were possible to obtain total actual costs rather than net material and labor figures which are often given out as such, the public would learn a great deal about economical expenditure of public construction funds and would insist upon such work being done by skilled contractors, bonded to deliver a satisfactory job strictly in accordance with plans and specifications and at a definite figure kept at a practical minimum of cost by competitive bidding.

For the benefit of the engineer who is tempted to eliminate the contractor, we would like to recommend a half-hour spent on an article by Arthur Bent, "Partners in a Great Adventure" which appeared in the *Constructor* for October, 1922. Mr. Bent's appeal to the engineers and architects for a square deal and fair play in construction, strikes at the seat of one of the most vital problems in the industry today.

By H. H. Wilson
Managing Partner,
Winston & Co., Contractors, Muncy, Pa.

IT IS pleasing to note the practically uniform viewpoint indicated in your columns by representatives of various construction machinery manufacturers concerning the inadvisability of advertising record runs of equipment. The position of constructors as to this matter is, I believe, similar to their attitude regarding publication of cost data by manufacturers, viz.: that such figures are too often unaccompanied by a sufficiently detailed statement of all factors involved to make it possible to dissect and apply them or parts of them to varying conditions. There will undoubtedly be ready response from constructors to the statement already made in your column that "Long time average runs will offer more benefit to the manufacturer and, at least, be of more value to the reader than the occasional flashes."

The thoughtful and experienced constructor, with his mind centered upon cost and efficiency, always seeks for high *averages* rather than records. I believe that manufacturers should offer constructors all possible information to assist in convincing them that they have a durable and efficient machine and to facilitate the obtaining of maximum results from the use of their equipment by purchasers. Anything beyond that would appear, as indicated by Mr. Talbot, to fall within the

province of the consulting engineer or cost expert. It is questionable whether, in invading such fields, manufacturers are following their own ultimate interests, which are to assist in building up more conservative and responsible construction concerns with whom to conduct their future business.

Receiver for Filter Company

On May 19 the U. S. District Court for New Jersey appointed William B. Anderson, president of the company and Andrew J. Steelman, an attorney of Newark, receivers for the New York Continental Jewell Filtration Co. of Nutley, N. J. Several years ago, according to Mr. Anderson, the company incurred large losses on several unprofitable contracts, but the organization has a good business and assets, which, if properly conserved and administered, will probably be sufficient to meet its other indebtedness in full.

Business Notes

ATRAX CORP. OF AMERICA, New York, is the name of a new organization formed by a syndicate headed by Felix F. Wiener and Arthur Sachsse, for the production of reconstructed stone, using the Fisher hydraulic ramming machine, and for the promotion of the manufacture of cement roof tiles and partition wall blocks. The corporation intends to give a nation-wide service to users of the machine and to promote a demand for its products.

WARNER ELEVATOR MANUFACTURING Co., Cincinnati, has completed an addition of 35,000 sq.ft. to its Cincinnati plant, which results in a main shop of two stories and basement, 500 ft. long and 200 ft. wide. This is claimed to be the second largest factory in the world for the exclusive manufacture of electric passenger and freight elevators.

FEDERAL TANK & PIPE Co., Seattle, Wash., has been organized for the manufacture of wood stave pipe and wood tanks. The president of the new organization is C. A. Paul, formerly connected with the Continental Pipe Manufacturing Co. and its predecessor, the Pacific Coast Pipe Co.

CROCKER-WHEELER Co., Ampere, N. J., announces that at its annual meeting of stockholders and directors May 9 Edmund Lang, previously vice-president and secretary, was elected president to fill the vacancy caused by the death of Dr. Schuyler S. Wheeler. Herbert C. Petty, formerly assistant sales manager, was appointed sales manager and secretary, succeeding Mr. Lang.

GENERAL SUPPLY & EQUIPMENT Co., Baltimore, has been incorporated by Henry C. Rippel, R. P. Carruthers, and B. H. McKindless, as dealers in building equipment and supplies.

WEBSTER MANUFACTURING Co., Chicago, announces the appointment of Robert T. Pierce as manager of its New York sales office to succeed Glen N. Porter, who died March 31.

Equipment and Materials

Mechanical Mucking Machine for Mine and Tunnel Work

FOR loading lead ore into cars in mine workings the engineers of the St. Joseph Lead Co., whose mines are in southeast Missouri, have developed an electrically operated power shovel or loader, with crawler traction and revolving superstructure, weighing 13 tons. The machine is adapted to the handling of tunnel muck and to other uses than mine work.

A truck carried by the crawlers has a turntable on which is mounted a frame 11 ft. long with a boom consisting of two tubular legs 10½ ft. long and a cross-member having arms between which a bucket is journaled. Each boom leg has its heel pivoted to a crosshead moving in horizontal guides on the side of the frame. An A-frame with backstay rods carries the sheaves of the boom topping lift. The bucket, about 4 ft. long and 2¾ ft. wide, has a notched

lip of manganese steel. It is held in the loading position by a latch on the cross-member of the boom; when unlatched by a trip operated by a light cable the bucket tilts forward to dump its load. When empty, the bucket returns automatically to its latched position, as its center of gravity is behind the trunnions.

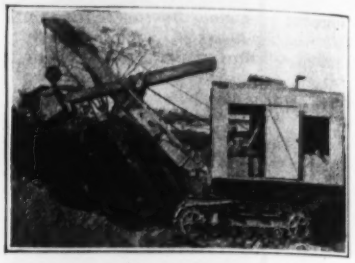
In loading, the boom is thrust forward, with a maximum crowding stroke of 7 ft., by means of sprocket chains attached to the crossheads which carry the boom legs, the boom cable being simultaneously unreeled by a fusee drum at such a rate that the dipper travels in a horizontal path. The crowding, hoisting and swinging motions are each actuated through worm gears by separate reversible motors controlled by the operator through master switches and magnet contactors. Two 12-hp. motors operate the hoisting and swinging gears. A 20-hp. motor operates the crowding and the propelling mechanism.

With boom and dipper drawn back the total length is 15 ft. 5 in., of which 9 ft. is forward of the turntable center, so that with a 7-ft. stroke there is a working radius of 16 ft. In the working position the height is 7 ft. to head of A-frame, but this frame can be lowered to give a clearance height of only 4 ft. 10 in. The width over the boom is 6 ft. 3 in. In ordinarily good digging, with a swinging arc of about 120 deg. and with adequate car service, the machine, it is claimed, can load ore at the rate of one ton per minute, each complete cycle occupying 30 sec. or less and the dipper load averaging ½ ton. As in all work of this kind the actual output is usually limited by the car service.

This loader was invented by Arthur K. Mitchell, assistant to the president of the St. Joseph Lead Co., New York, N. Y. As a result of experience with the first machine twelve more are now being built.

New Size Gasoline Shovel Added to Company's Line

To the line of power shovels manufactured by the Pawling & Harnischfeger Co., Milwaukee, Wis., a new 1-yd. size, operated either by gas or electricity, has been added. It is similar



in design to the company's ¾-yd. and ¾-yd. machines and requires only one operator. The shovel is mounted on crawler traction, and is designed to come within standard railway clearances with a minimum amount of dismantling.

One of the features of the equipment is the manganese rack on the dipper stick driven by a heavy thimble roller chain from a set of planetary gears mounted on the forward drum. This arrangement, the manufacturer claims, gives a positive crowding motion regardless of the position of the dipper and enables the operator to bite into the heaviest digging. The outfit is convertible, by a change of booms, into a dragline, clamshell, piledriver, or crane hook.

Publications from the Construction Industry

Wood Pipe—CONTINENTAL PIPE MANUFACTURING Co., Seattle, has issued a 246-p. catalog, illustrated, dealing with its wire-wound wood pipe, continuous stave pipe, and creo-wood flumes. The wire-wound pipes range in diameter from 2 to 32 in., and the continuous stave pipe from 16 in. to 14 ft. The catalog contains information collected by the company during its thirty years of experience in the wood pipe industry, including hydraulic data and flow tables useful in the design of water conduits for municipal supply systems, hydro-electric developments, irrigation, sewerage, drainage, paper mills and other industries. Descriptions and illustrations are given showing the wide range of uses of wood pipe. In the preparation of the volume much care has been exercised and its contents are of decided technical value.

Hoisting Machinery — O. K. CLUTCH & MACHINERY Co., Columbia, Pa., in a 16-p. illustrated catalog, features hoisting machines made in single, double and triple drum reversible and non-reversible types, operated by gasoline engine or electric power. One page is devoted to the company's friction clutches.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Structural Steel Sales Decline

April sales of fabricated structural steel were less than the March record, according to figures received by the Department of Commerce through the Bureau of the Census, in co-operation with the Structural Steel Society. Sales in April amounted to 80 per cent of shop capacity as against 95 per cent in March and 88 per cent in April, 1922. Total sales of 176,954 tons were reported for April by firms with a capacity of 220,965 tons per month.

Tonnage booked each month by 171 identical firms, with a capacity of 226,625 tons per month, is shown below, togther with the per cent of shop capacity represented by these bookings. For comparative purposes, the figures are also prorated to obtain an estimated total for the United States on a capacity of 250,000 tons per month.

1922	Actual Tonnage Booked	Per Cent of Capacity	Estimated Total Bookings
April.....	199,494	88	220,000
May.....	183,089	81	202,500
June.....	167,641	74	185,000
July.....	155,298	69	172,500
August.....	154,676	68	170,000
September..	145,097	64	160,000
October....	131,303	58	145,000
November....	110,188	49	122,500
December..	136,168	60	150,000
1923			
January....	170,190	75	197,500
February...	182,056*	80	200,000
March.....	216,647**	96	237,500
April.....	176,954***	80	200,000

* Reported by 170 firms with a capacity of 226,425 tons.

**Reported by 167 firms with a capacity of 225,425 tons.

***Reported by 150 firms with a capacity of 220,965 tons.

No Sign of Building Slump, Say Brick Manufacturers

In its monthly digest of conditions in the industry, as of April 1, the Common Brick Manufacturers' Association discounts predictions of a building slump due to a buyers' strike. Reports from 128 companies throughout the country show a gain of orders in every district, without exception. This is characterized as "one of the most remarkable reports received during the history of this organization." A great deal of material that is being delivered now, the report states, is for jobs started in 1922. At the same time many new operations are said to be getting under way.

Th report cites a serious shortage in bricklayers and plasterers. The industry, in co-operation with others, is preparing a course of instructions for the training of bricklayers, which, the association states, will be available to any city that will undertake the enterprise. Orders on books on April 1 showed a gain of 161,000,000 brick as compared with March 1. Shipments of brick from plants in March exceeded production. On April 1 figures from 128 plants, of which 29 were closed down, reported 181,298,000 burned brick on hand, 44,940,000 unburned brick on hand, and orders on books for 463,752,000 brick.

April Employment in Industries

The U. S. Department of Labor, through the Bureau of Labor Statistics, here presents reports concerning the Volume of Employment in April, from 5,651 representative establishments in 43 manufacturing industries, covering 2,139,053 employees, whose total earnings during one week amounted to $55,353,080. Identical establishments in March reported 2,128,816 employees and total pay rolls of $54,573,958. Therefore, in April, as shown by these unweighted figures for 43 industries combined, there was an increas over March of 0.5 per cent in the number of employees, an increase of 1.4 per cent in the total amount paid in wages, and an increase of 0.9 per cent in the average weekly earnings.

Increases in the number of employees in April as compared with employees in identical establishments in March are shown in 19 of the 43 industries. The greatest increase was 12.2 per cent in brick and tile.

Heavy Freight Traffic Reported

Freight traffic on American railroads the first three months this year was the heaviest in history for that period of the year, according to reports just received by the Bureau of Railway Economics from the carriers. During the three months period, freight traffic totaled 109,546,090,000 net ton-miles. This was not only an increase of nearly 24 per cent over the first three months last year, but also was an increase of 3.6 per cent over the total for the corresponding period in 1920 which was the previous record. The total for the first quarter this year exceeded by even a greater percentage that for the corresponding periods in not only 1921, but also 1917, 1918 and 1919.

Record Freight Loadings

Loading of 974,531 cars of revenue freight for the week ended May 12 was the highest for this time of year in history, according to reports filed by the carriers with the Car Service Division of the American Railway Association.

This was not only the greatest loading for any one week since Nov. 4, 1922, but was approximately within 4 per cent of the greatest loading for any one week in history which was that of Oct. 14, 1920, when the total was 1,018,539 cars. Compared with the corresponding week last year, the total for the week of May 12 was an increase of 207,437 cars, and an increase of 223,345 cars over the corresponding week in 1921.

Loading of freight cars this year to date, compared with those of the two previous years, follows:

	1923	1922	1921
Month of January	3,380,296	2,785,119	2,823,759
Month of February	3,366,965	3,027,886	2,739,234
Month of March	4,583,162	4,088,132	3,452,941
Month of April	3,763,963	2,863,416	2,822,713
Week ended May 5	961,029	747,200	721,722
Week ended May 12	974,531	767,094	751,186
Total for year to date	17,029,946	14,278,847	13,311,555

Report Against Cut in 12-Hour Day in Steel Industry

Acting on recommendations of a special committee appointed last year at the request of President Harding, the American Iron and Steel Institute, at its annual meeting in New York May 24, unanimously opposed the abandonment of the 12-hour day in the iron and steel industry. The report of the committee, which was headed by Elbert H. Gary, chairman of the board, U. S. Steel Corp., maintained that the 12-hour day in the steel industry was not injurious to employees physically, mentally or morally, and that hours of labor could not be shortened without curtailing needed production. The committee stated that a shortening of the 12-hour day would require 60,000 additional employees and would result in a 15 per cent increase in prices.

Gary Sees Continued Demand for Steel

In his presidential address before the annual meeting of the American Iron and Steel Institute in New York May 25 Elbert H. Gary, chairman of the board, U. S. Steel Corp., stated that "there is nothing in sight to indicate that there will be a substantial diminution of the demand for finished steel in this country during the next six months, to say the least." At present, he said, the furnaces and mills of iron and steel manufacturers are operating nearly to full capacity, limited and modified only by a lack of sufficient working forces. The producers, for months past, have found it difficult to satisfy the "peremptory demands" of consumers.

"There has of late," Judge Gary continued, "been a deliberate and persistent attempt to create an impression that there will be in the near future a substantial recession in business activities. Business men generally understand this. The propaganda is inspired by a few short-sighted persons who do not seem to understand that if they could succeed in wrecking the business structure they would themselves be buried in the ruins. However, the postponements in some lines of business operations have not wholly resulted from deliberate and unworthy propaganda. In the building lines particularly, where work has not already been commenced, projected operations more or less have been postponed by reason of the extraordinary and inordinate prices charged by certain trades for wage rates, and also by the numerous strikes or threatened strikes for still higher wage rates.

"As often stated publicly, 85 per cent or more of the cost of producing

steel, from the raw products to the finished material, is paid to the workmen. When, in order to secure sufficient workmen on buildings, contractors are compelled to pay the carpenters, painters, bricklayers, plasterers, plumbers and others in kindred lines, $10 and upward per day of eight hours, and this to workmen who are demanding a five-day week, with arbitrary limits of the work done, it is not surprising if the building of costly structures is being postponed until more favorable conditions shall obtain.

"Building operations, though important, are a small percentage of our business. Even though there should be no more new contracts for structural steel during the next six months, apparently the steel business taken as a whole would be satisfactory."

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 319 to 332, are the following:

Hotel, Hot Springs, Ark., for Arlington Hotel Co., $2,500,000.

Temple, New Castle, Pa., for Scottish Rites Bodies, F. and A. M., $1,000,000.

Hotel, Madison, Wis., for Hotel Wisconsin Realty Co., Milwaukee, $1,000,000.

Jurisdictional Board Stands Firm

The Joint Board for Jurisdictional Awards in the Building Industry has declined to change its ruling made two years ago awarding metal trim work to the Metal Workers union. Because of this ruling, the Carpenters union has declined to recognize the authority of the Board, claiming that the ruling was made without a presentation of the case on behalf of the carpenters. The carpenters had obtained several postponements of the hearing and their representative withdrew from the Board when the majority decided that no further delay should be granted.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted. Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section. The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of May 3; the next, on June 7.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.30	$4.50	$3.40	$3.55	$4 20	$3.85	$4.10	$3.75
Structural rivets, 100 lb.	4.40	5.00	—4.90	3.75	4.25	5.15	5.00	4.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	4.25	3 70	3.32½	3.45	3.85	3.65	4.10	3.50
Steel pipe, black, 2½ to 6 in. lap, discount	49%	50%	45%	59½%	53-5%	36%	35.2@47.6%	40%	32.76
Cast-iron pipe, 6 in. and over, ton	62.50@63.50	—53.00	63.00	60.20	60.50	69.00	60.00	70.00	60.00
Concreting Material:									
Cement without bags, bbl	2.70@2.80	+2.85	2.25	2.20	2.39	2.85	2.71	2.90	2.68
Gravel, ¾ in., cu.yd	2.25	1.90	2.25	2.00	1.75	1.90	2.15	1.25	1.50
Sand, cu.yd	1.25	1.24	1.95	2.00	1.00	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd	1.75	2.00	2.50	2.00	2.25	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	65.00	42.00	53.00	60.00	45.75	44.00	41.00	31 00	90.00
Lime, finishing, hydrated, ton	18.60	23.50	22.50	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1 50	2.50	1.50	1.50	2.70	1.75	2.80	11.00
Common brick, delivered, 1,000	23.50	14.00	—12.90	11.00	17@19	12.00	15.00	13.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.0893	.115	.1032	0836	.065	....	.11	.115
Hollow partition tile 4x12x12, per block	.1573	.0893	.115	....	....	.065	.108	.11	....
Linseed oil, raw, 5 bbl. lots, gal.	1.16	+1.26	1.35	1.37	1.29	1.39	1.24	.86	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.56½	....	....
Common labor, non-union, hour	.....	.30	.30@.50	.72½	.35@.50	.35@.50	.50	.50@.62½	.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 81½c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.74). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $32.76; 6-in., $108.

Changes Since Last Week

Structural steel market stable during week, but with an easier tone. The minimum on steel bars is now placed at $2.40 per 100 lb., with shapes $2.50, on all current mill business. The maximum, however, does not exceed $2.60. Plate inquiries continue fair, especially for ship and tank construction, with buying a trifle slower. The minimum on steel plates is now $2.50 per 100 lb., Pittsburgh, for prompt deliveries. Steel mill shipments continue heavy.

The only prices changes in seven cities reporting weekly to *Engineering News-Record*, were as follows: A drop of $2 per ton in cast-iron pipe, and advances of 5c. per bbl. in cement and 2c. per gal. in linseed oil, in Atlanta; declines of 35c. per 100 lb. in structural rivets and 20c. per M. in common brick, in Dallas.

The labor situation in New York City was marked last week, by the granting of wage demands to the painters. This week's developments reveal similar concessions to the stone cutters and planer men, who received an increase of $1 per day. Bricklayers, however, still hold out for the two year contract of $12 per day, against a three-year agreement at $10, with a bonus of $2 per day, as offered by the employers. Brickyard workers are still on strike in the Raritan district with the Hudson River district not visibly affected.